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Essays on Brand Architecture and Individual Brand Performance

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Essays on Brand Architecture and Individual Brand Performance

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ABSTRACT

Essays on Brand Architecture and Individual Brand Performance

By Vijaymahadev Viswanathan

The objective of this dissertation is to understand the relationship between brand architecture design and the performance of individual product brands. Brand architecture is the logical, strategic and relational structure for all the brands in an organization's brand portfolio. A commonly used architecture is a brand hierarchy (Corporate Brand → Family Brand → Individual Brand). Two aspects succinctly characterize a brand hierarchy: 1) its breadth, which describes the number and/or heterogeneity vis-à-vis those categories where brands in the hierarchy compete; and, 2) its depth, which describes the levels in the hierarchy.

Essay #1 develops and tests theory for how and why brand hierarchy and the marketing effects aimed at different levels of the hierarchy impact the performance of an individual (product) brand. The theory is based on the notion that marketing efforts aimed at higher levels in a brand hierarchy are moderated by the breadth and depth of the hierarchy. Results using data from the U.S. automobile category are broadly in line with the theoretical framework. Policy simulations on brand pruning and reallocation of advertising effort reveal interesting and useful insights for academics and managers.

Essay #2 examines how the performance of an individual product brand is affected by two forms of congruence/incongruence: 1) within-category incongruence, or the extent to which an individual product brand differs from its competitors in its focal category; and, 2) across-category incongruence, or the extent to which an individual brand differs from products outside the focal category which share its brand name.

Results from the analysis of four product categories in the consumer packaged goods category suggest that the marginal value from increasing within category incongruence and the typicality of an extension with its parent brand play an important role in influencing the performance of the individual brand. More importantly, results reveal consumers' preferences for within and across-category incongruence change over time.

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1 Introduction

Many firms have a portfolio of brands, whose purpose is, in part to cater to the different needs of consumers, markets and channels. Aaker and Joachimsthaler (2000, p.133) suggest that managing brands as stand-alone silos is a recipe for confusion and inefficiency. Firms, therefore, design brand architectures to help various brand teams function as a unit. Aaker and Joachimsthaler define brand architecture as "an organizing structure of the brand portfolio that specifies the brand roles and relationships among brands and different product-market contexts". However, the importance of brand architectures remains largely confined to business magazines and books. The few studies that do study brand architecture examine its relationship with firm-level financial market performance (e.g., Rao, Agarwal and Dahlhoff 2004) and not with individual brand-level. This dissertation proposes to make a significant contribution to the marketing literature as it conducts a rigorous analysis of brand architectures that firms typically employ and their impact on individual brand performance.

Keller's (2008) brand hierarchy framework (Corporate brand → Family brand → Individual brand → Descriptor) succinctly captures the elements of brand architecture. Brand hierarchies are a way for firms to make connections across products and brands, highlighting to consumers how products and brands are related. Examples abound from a wide variety of industries, including automobiles (General Motors → Chevrolet → Suburban → Denali), entertainment (TimeWarner → Turner Broadcasting System → CNN → Headline News), bicycles (Trek → Hardtail → Alpha Aluminum), consumer packaged goods (Kellogg's → Special K → with Berries), and technology products (Dell → Dimension → E510), to name a few. In practice, two or three levels are most common. The corporate brand and family brands

are often referred to as parent brands. An individual brand is often restricted to a category though it may be used for different types (e.g., car models) in the category.

Keller's brand hierarchy framework has two components 1) breadth, which encompasses across-category extensions and number of distinct brands within a category, and 2) depth, which varies depending on the number of distinct brands across levels of the hierarchy. Hence, the breadth of a hierarchy depends on the breadth of the branding strategy and the depth of the branding strategy. Each parent brand in the hierarchy, corporate or family, has a breadth depending on the categories it is stretched across and the number of distinct individual brands in each category. The depth of the hierarchy varies depending on the presence or absence of a distinct family brand. For instance, while the individual brand Tahoe has distinct corporate and family brands General Motors and Chevrolet respectively, Pilot has a common corporate and family brand Honda. Hence, Tahoe is placed two levels below the corporate brand and Pilot is placed one level below a common corporate/family brand.

In the first essay of the dissertation, I examine how the breadth of the hierarchy and the position of the individual brand with respect to the depth of the hierarchy affect individual brand performance. The theoretical framework is based on the notion that while marketing efforts aimed at higher levels of the hierarchy influence individual brand performance, the effects of the corporate and family brands are moderated by the breadth and depth of the hierarchy. I use 11 years of quarterly data from the US automobile industry to carry out the analysis. Results from a random coefficient logit model are broadly in line with my expectations. This study will help

firms understand how brand architecture impacts individual brand performance. It will also help them decide where to allocate their marketing resources in the brand architecture.

In the second essay, I examine how breadth of the parent brand and the individual brand's location vis-à-vis its competitors in the category (i.e., category incongruence) affect its performance. Here, I test competing theories from the consumer behavior and economics literature to explain how within category incongruence affects individual brand performance. I also clarify the process through which the breadth of a parent brand affects individual brand performance. Results from four categories in the consumer packaged goods industry suggest that the marginal value from increasing incongruence plays an important role in influencing the performance of the individual brand. An important result is that the within and across category effects vary over time. The shifting preferences are presumably due to consumers gaining experience with the category as they try various alternatives.

2 ESSAY 1: Brand Hierarchies and Individual Brand Performance

2.1 Introduction

Brand architecture is the logical, strategic and relational structure for all the brands in an organization's brand portfolio. In this, I focus on brand architectures organized as a hierarchy such as corporate brand, family brand, individual (product) brand, and possibly a brand modifier and/or brand ingredient. Brand hierarchies are a way for firms to make connections across products and brands, highlighting to consumers how they are related. Examples abound from a wide variety of industries, including automobiles (General Motors → Chevrolet → Suburban → Denali), entertainment (TimeWarner → Turner Broadcasting System → CNN → Headline News), bicycles (Trek → Hardtail → Alpha Aluminum), consumer packaged goods (Kellogg's → Special K → with Berries), and technology products (Dell → Dimension → E510), to name a few. In practice, two or three levels are most common.

I develop and test a theoretical framework to explain how individual (product) brand performance is affected by the brand hierarchy in which it exists. The theory is based on the notion that, while marketing efforts aimed at higher levels of the hierarchy influence individual (product) brand performance; these efforts are moderated by the breadth and depth of the hierarchy. Different from previous studies of brand architecture, this study 1) examines observed (product) brand-level performance (rather than consumer mindset or consumer intentions), 2) is comprehensive, controlling for multiple explanations for individual (product) brand performance, and 3) investigates a category (automobiles) where usage of brand hierarchies is widespread yet insights into their impact is lacking and the ramifications of such understanding can have a significant impact on marketing practice.

The article is organized as follows. I first briefly review prior studies of brand architecture as they relate to brand hierarchies and brand performance. Next, I present my conceptual model that describes how brand hierarchy affects individual (product) brand performance. I test the model using a random coefficients logit model calibrated on data from the U.S. automobile industry. The modeling framework accommodates unobserved heterogeneity, uses an instrumental variable technique to account for price endogeneity and does not impose any restriction on the form of competition between brands. The results of the analysis are broadly in line with the conceptual model. I then conduct policy simulations to gain insights on how changes in brand hierarchy and communication efforts at different levels of the brand hierarchy affect individual (product) and consequently, firm performance. I conclude with a discussion of the empirical results and managerial insights gained from the findings.

2.2 Background

I first discuss a number of concepts related to brand hierarchies, which is useful in part because terminology in the branding literature is often inconsistent. As an example, consider that some authors use the term brand extension generally to include all extensions, whereas others understand it to mean only category extensions (which exclude line extensions)

- "Umbrella branding" refers to using the same brand name in multiple product categories (Erdem 1998). For example, the Crest brand is used on multiple oral care products such as toothbrushes and toothpaste (Erdem 1998). Hence, any brand in a brand hierarchy that is used in more than one product category is an umbrella brand. Umbrella branding does

not necessarily imply a brand hierarchy (e.g., Del Monte canned beans, Del Monte canned peas), nor does a brand hierarchy always contain an umbrella brand.

- Early studies used the term "family brand" to refer to the same concept as umbrella branding defined above (Fry 1967; Neuhaus and Taylor 1972). However, usage of the term "family brand" has evolved to imply a brand hierarchy. The American Marketing Association's definition includes the requirement that "individual members of the family also carry individual brands to differentiate them from other family members (marketingpower.com)." A family brand is "not necessarily the name of the company or corporation itself (Keller 2008)".
- The highest level in a brand hierarchy is the "corporate or company brand". The term branded house describes a firm-level branding strategy where a firm uses the corporate name dominantly in all their products and services (Rao et al. 2004). In practice, a branded house often involves a brand hierarchy (e.g., Dell → Latitude, is coded as a branded house by Rao et al.) where the brands below the corporate brand receive relatively little emphasis.
- Following Keller, I define an "individual brand" as a brand that has been restricted to one product category or product type within a category. This is different from Smith and Park (1992) who use the term to describe a situation where a brand name is used only on a single product (versus multiple products following introduction of a brand extension).
- Consistent with tree diagram terminology, I use the term "parent brand" to describe the brand one level above a focal brand in a brand hierarchy; or viewed top-down, a brand with one or more brands below it in a brand hierarchy. This usage differs from the brand

extension literature which has used the term "parent brand" to refer to an established brand name that is used to introduce a new product (by analogy the existing brand gives birth to a brand extension).

- I use the term "sub-brand" to refer to combining brand elements in a parent-child (or master brand – subordinate brand) relationship. This is consistent with Aaker (2004) who states that a sub-brand "modifies a master brand by adding to or changing its associations (p.57)". This usage is broader than Farquhar, Yan, Herr and Ijiri (1992) who use sub-branding to mean only adding elements or modifiers to signal refinements such as "different quality levels, flavors, or functions" (versus adding elements or modifiers that signal product improvements, which they call super-branding).
- Finally, brand hierarchies are defined by a firm's branding efforts from the perspective of the end consumer. Hence, they need not be related to a firm's legal structure, where the legal corporate brand may be emphasized only to the investor community (e.g., Altria Group, parent of Kraft Foods) and/or the distribution channel. I discuss this point in greater detail below.

To date, research focusing on individual (product) brand performance has largely ignored branding strategy. Efforts to study how a firm's branding strategy affects performance have largely been restricted to firm-level studies. Examples include studies which have looked at the relationship between a firm's branding strategy and its intangible value (Rao et al. 2004), the impact of brand portfolios on firm-level financial performance measures (Morgan and Rego 2009), and inferring a firm's brand equity based on its financial market performance (Simon and Sullivan 1993).

The few studies that have incorporated aspects of brand strategy when studying individual (product) brand performance have found that there exists spillover effects across umbrella brands (Erdem and Sun 2002); lower variance in the quality of brand (category) extensions can influence consumer confidence in the brand (Dacin and Smith 1994); and, consumer evaluations of brand extensions are driven by image consistency (Park, Milberg and Lawson 1991), typicality and breadth (Boush and Loken 1991) and fit (Aaker and Keller 1990; Broniarczyk and Alba 1994). All these studies examine either elements of (but not the entire) brand architecture, or do not study the impact of brand architecture on individual (product) brand performance. Different from these studies, I am interested in how brand hierarchy affects individual (product) brand performance through consumers' cognitive processes.

To summarize, the behavioral literature explains the impact of brand architecture on consumer mindset and the cognitive drivers of consumer behavior, but has yet to explain how these cognitive processes affect a brand's product-market performance. The individual (product) brand performance literature has examined determinants of brand performance, but largely without consideration of brand architecture. Given these two streams of research, there remains a void explaining how brand hierarchy affects individual (product) brand performance. The goal of this research is to bridge these two areas and present a framework that explains how brand hierarchy, specifically arising from variation in the breadth and depth of a brand hierarchy across brands, impacts individual (product) brand performance. I also seek to answer what levels of the hierarchy should be emphasized while communicating with the consumer to improve individual (product) brand performance.

2.3 Theoretical Development

Technically, the highest level of a brand hierarchy always consists of one brand, the corporate brand. At the next-lower level is a family brand, which is used on more than one product category. If the corporate brand is applied to a range of products, then it functions as a family brand too, and the two levels collapse to one for those products. An individual (product) brand is a brand that is typically restricted to essentially one product category. Figure 1 presents the brand hierarchy for a complex hierarchy, General Motors. For exposition, under each family brand, the individual (product) brands are grouped by vehicle type.

Strategic decisions include the depth and breadth of the brand hierarchy, and what levels of the brand hierarchy to emphasize. The depth of the hierarchy refers to the number of levels above the individual brand, with one being most common and two being used in more complex architectures. The breadth of a parent brand's hierarchy is the diversity or heterogeneity of product classes that it competes in. A parent brand's breadth is affected by both the number of individual brands in each product category the parent brand competes in, and by the similarities and differences in the product categories those sub-brands compete in. Specifically, increasing the number of individual brands in a category or pruning the number of categories a parent brand competes in reduces the breadth of the parent brand. For example, the breadth of the family brand Chevrolet is affected by the categories it spans (e.g., cars, pickups, SUVs etc.) and the distinct brands in each category (e.g. Aveo, Impala, Malibu, etc. in the car segment; Suburban, Tahoe etc. in the SUV segment; and so on).

2.3.1 Depth of Brand Hierarchy

At the lowest level in the hierarchy, the individual (product) brand, the firm can convey product-specific information. Each level above the individual (product) brand can be used to convey additional information. Developing brands at higher levels of the hierarchy provides an economical means of providing common information about a set of individual (product) brands and also linking those individual brands in consumers' minds. Using a common brand across categories saves brand development costs (e.g., Lane and Jacobson 1995), and enhances a firm's marketing productivity (e.g., Rangaswamy, Burke and Oliver 1993). Because each successive higher level in the hierarchy spans more individual (product) brands (and thus more categories), the common information provided is naturally more abstract and less product- and/or product category-specific at higher levels.

The number of levels in the hierarchy determines the combination of separate and shared brand associations that link to any one product. A corporate brand is typically associated with abstract associations such as credibility and reputation (Berens, Riel and Bruggen 2005; Brown and Dacin 1997). In a hierarchy with high depth, a distinct family brand modifies the abstract associations of the corporate brand and is associated more with product-related attributes (Keller 2008; Sujan and Dekleva 1987). However, in a hierarchy with low depth, the common corporate and family brands convey the same information[1]. Therefore, in a brand hierarchy with high depth, inconsistent information from the corporate brand and distinct family brand can lead to discounting of information and lowers consumers' beliefs about the product (Fishbein and Ajzen

[1] Results from a content analysis of advertising campaigns in the automotive industry lend support to this statement. The procedure followed for the content analysis and the results are detailed in the Research Design section.

1975). Also, increasing quantity of information from the distinct corporate and family brands can result in information overload and hurts the effectiveness of consumers' decision-making (e.g., Keller and Staelin 1987, 1989). All else equal, I expect that greater depth (more levels) is associated with lower individual (product) brand performance.

In a brand hierarchy with high depth, there is high redundancy in the information carried by the distinct family brand and the individual brand as they both convey product-related information. However, in a hierarchy with low depth, there is low redundancy in the information carried by the individual brand and the family brand (which is also the corporate brand). Previous work suggests that high information redundancy inhibits acquisition of information (Granovetter 1973; Kahnemann 1973) and does not weigh heavily in judgment (Wilton and Meyers 1986; Wyer 1970; Wyer and Carlston 1979). Hence, increasing depth reduces the effectiveness of family brand communication efforts. Similarly, since in a hierarchy with high (low) depth there is low (high) redundancy in the information carried by the corporate brand and the individual brand, increasing depth increases the effectiveness of corporate brand communication efforts.

2.3.2 Breadth of a Brand Hierarchy

The breadth of a brand hierarchy is related to the diversity or heterogeneity in the product categories that it competes in. Breadth can vary over time as a firm introduces (e.g., Cayenne SUV by Porsche), acquires (e.g., Ford Motor Company's acquisitions of the Land Rover, Jaguar, and Volvo brands), or deletes (e.g., Oldsmobile) sub-brands. Where a firm has multiple family brands, each can have a different breadth (e.g., General Motor's Chevrolet brand family includes

individual (product) brands competing in the truck, SUV, small car, midsize car, large car, and sports car categories, whereas individual (product) brands under the GMC family brand are limited to trucks and SUVs.). Breadth can vary across firms: General Motors (GM) sells numerous individual (product) brands through its family brands such as Chevrolet, Pontiac (recently deleted), Buick, Cadillac, Saturn and GMC, Saab and Hummer; Toyota has fewer family brands (Toyota, Lexus and Scion) and fewer individual (product) brands under each of these family brands. Strategic decisions with respect to breadth include the number of unique sub-brands, and what product categories they compete in.

The breadth of a parent brand decreases with increasing similarity or homogeneity in the product classes that it competes in. Previous work in the categorization literature has found that high similarity results in greater coherence and subjects prefer a member of a coherent category over that of an incoherent category (Patalano, Chin-Parker and Ross 2006). The underlying process is that with increasing similarity in the categories that a parent brand competes in (i.e., low breadth), commonalities of features in different categories creates more alignable differences than non-alignable differences (Markman 2001). Consumers not only focus and recall more alignable differences than non-alignable differences (Markman and Gentner 1993a; Tversky 1977) but also use them while making judgments and choice (Markman and Medin 1995; Slovic and Macphillamy 1974). This suggests that low breadth of the parent brand results in higher individual (product) brand performance and vice versa.

When a parent brand has low breadth, its coherence increases (Patalano et al. 2006). Studies have also found that coherent categories are used more readily than incoherent categories

as a source of property transfer and extensions and that they help consumers make stronger inferences (e.g., Rehder and Hastie 2004; Patalano, Wengrovitz and Sharpes 2009). Therefore, when a parent brand has low breadth, it facilitates communication efforts of the parent brand to transfer its associations to the individual (product) brand and helps consumers in their decision making process. Hence, the effectiveness of parent brand communication efforts is higher for a parent brand with low breadth. On the other hand, when a parent has high breadth or low coherence, it is limited in its ability to transfer its associations to the individual brand and help consumers make strong inferences. This in turn, lowers the effectiveness of its communication efforts. Therefore, as the breadth of the parent brand increases, I hypothesize that the effectiveness of its communication efforts on individual (product) brand performance decreases.

2.4 Research Design

2.4.1 Model Specification

Since the individual (product) brand's market share is the dependent variable and data exist at the market-level, I could consider an aggregate demand logit model (Besanko, Gupta and Jain 1998) to estimate the parameters. However, the cross price elasticities estimated using this approach results are unrealistic as they are function of the individual (product) brand's market shares. I, therefore, use the flexible random coefficients logit model of demand that models the heterogeneity in consumer preferences and also tackles the issue of price endogeneity prevalent in market-level data. I follow the estimation approach suggested by Nevo (2001).

Consumer *i* faces a choice of *J* individual (product) brands in period *t* and an outside good *j=0*. To maximize her utility, she solves the optimization problem:

(1) $$\max_{j \in (0,\ldots,J)} u_{ijt} = \alpha \ln\left(Price_{jt}\right) + \sum_k x_{jkt}\beta_k + \xi_{jt} + \sum_k \sigma_k x_{jkt} \upsilon_{ik} + \varepsilon_{ijt}$$

where, u_{ijt} is the utility of individual (product) brand j to consumer i in period t; $Price_{jt}$ is the list price of individual (product) brand j. x_{jkt} is the kth observed characteristic in vector X_{jt}. Specifically, X_{jt} comprises of marketing mix, product characteristics and brand hierarchy variables of brand j in period t. ξ_{jt} is the unobserved product quality. ε_{ijt} is the random utility across individual (product) brands and consumers and is assumed to be distributed i.i.d. Type1 extreme value. Consumer i gains $x_{jkt}\left(\beta_k + \sigma_k \upsilon_{ik}\right)$ from characteristic x_{jkt}. $\beta_k x_{jkt}$ is the average utility to all consumers from characteristic k and $\sigma_k \nu_{ik} x_{jkt}$ represents the deviation for consumer i from that average. I assume that υ is drawn from a standard normal distribution and σ_k is the standard deviation in the utility that consumers get from characteristic k.

The utility for the outside good, assuming $Price_{0t} = 0$ and $x_{0t} = 0$, is:

(2) $$u_{i0t} = \xi_{0t} + \sigma_0 \nu_{i0} + \varepsilon_{i0t}$$

The outside good captures utility from products other than the individual (product) brands. I capture the heterogeneity in valuation of the outside good through $\sigma_0 \nu_{i0}$.

Berry, Levinsohn and Pakes (1995) interpret ξ_{jt} as the component unobservable to the researcher. However, it is observable to both, the firm and the consumer and, therefore, influences prices.

The utility equation can now be written as:

(3) $$U_{ijt} = \delta\left(Price_{jt}, X_{jt}, \xi_{jt}, \theta_1\right) + \mu\left(X_{jt}, \nu_i, \theta_2\right) + \varepsilon_{ijt} = \delta_{jt} + \mu_{ijt} + \varepsilon_{ijt}$$

where $\theta_1=(\beta_1,\ldots, \beta_k)$ is the set of parameters associated with consumer independent characteristics, $\theta_2=(\sigma_1,\ldots,\sigma_k)$ is the set of parameters associated with consumer characteristics $\upsilon_1=(\upsilon_{i1,\ldots,} \upsilon_{ik})$. $\delta(.)$ is a function independent of consumer characteristics while $\mu(.)$ is dependent on consumer characteristics.

I now obtain the logit formula for the probability of household *i* buying individual (product) brand *j* in period *t*:

(4) $$s_{ijt} = \frac{\exp\left(\delta_{jt} + \mu_{ijt}\right)}{1 + \sum_{m=1}^{J} \exp\left(\delta_{mt} + \mu_{imt}\right)}$$

Hence, the market share of brand *j* in period *t* is:

(5) $$s_{jt} = P(\upsilon) \int_{\upsilon} \frac{\exp\left(\delta\left(Price_{jt}, X_{jt}, \xi_{jt}, \theta_1\right) + \mu\left(X_{jt}, \nu_i, \theta_2\right)\right)}{1 + \sum_{m=1}^{J} \exp\left(\delta\left(Price_{mt}, X_{mt}, \xi_{mt}, \theta_1\right) + \mu\left(X_{mt}, \nu_i, \theta_2\right)\right)} \, d\upsilon$$

where, $P(\upsilon)$is the joint distribution over all the elements of $\upsilon_i=(\upsilon_{i1}, \ldots, \upsilon_{ik})$. Since the integral of the above equation has no closed form, simulation is used to compute an approximation of the market share of individual (product) brand *j* in period *t*. I draw *n* vectors of υ_i from $P(\upsilon)$ and obtain an approximation of the above integral:

(6) $$S_{jt} = \frac{1}{n} \sum_{i=1}^{n} \frac{\exp\left(\delta_{jt} + \mu\left(X_{jt}, \nu_i, \theta_2\right)\right)}{1 + \sum_{m=1}^{J} \exp\left(\delta_{mt} + \mu\left(X_{mt}, \nu_i, \theta_2\right)\right)}$$

Since ξ_{jt} is correlated with price, I need to use an instrumental variables approach to solve the endogeneity problem. However, ξ_{jt} enters the equation in a nonlinear fashion. I, therefore, use the contraction mapping theorem (Berry et al. 1995) to solve:

(7) $$\delta_{jt}^{h+1} = \delta_{jt}^{h} + \ln\left(S_{jt}\right) - \ln\left(s\left(Price_{jt}, X_{jt}, \delta_{jt}^{h}, P_n; \theta_2\right)\right)$$

where S_{jt} is the observed market share and $s(.)$ is the computed market share from the equation.

To speed up the computation process and avoid using log forms, I solve for $\omega_{jt} = exp(\delta_{jt})$ (Nevo 2001) with the following contraction mapping theorem:

(8) $$\omega_{jt}^{h+1} = \omega_{jt}^{h} \frac{S_{jt}}{s\left(Price_{jt}, X_{jt}, \delta_{jt}^{h}, P_n; \theta_2\right)}$$

The demand side errors conditional on θ_2 are now computed as,

(9) $$\xi_{jt} = \delta_{jt}\left(\theta_2\right) - X_{jt}\theta_1 .$$

Following Berry et al. (1995), I use the Generalized Method of Moments (GMM) procedure for the estimation. If Z is the set of instruments, and is exogenous and independent of the error term in the demand equation ξ, $E(Z' \xi)=0$. This serves as the moment condition in the procedure. Therefore, if θ is the vector of parameters to be estimated,

(10) $$\hat{\theta} = \underset{\theta}{\arg\min}\ \xi' Z \Phi^{-1} Z' \xi$$

where, Φ is a consistent estimate of $E(Z \xi' \xi Z')$.

Price elasticity of individual (product) brand *j* can be computed approximately as,

$$\eta_j^k \approx (\frac{p_k}{s_j}) \sum_{i=1}^{ns} \frac{(\alpha + \sigma_p \upsilon_i)}{p_k} (-s_{ij} s_{ik} + 1_{(k=j)} s_{ik}) \quad (11)$$

where, $\sigma_p \upsilon_i$ is the deviation from the mean utility that individual *i* derives from price.

I can similarly compute the elasticities of corporate, family and individual (product) advertising efforts. Here, it is important to note that the interaction effects of breadth and depth of brand hierarchy with family and corporate brand communication should also be taken into account. For instance, the family brand advertising elasticity is,

$$\lambda_j^k \approx (\frac{FamilyAdv_k}{s_j}) \sum_{i=1}^{ns} \frac{(\beta_{FamAdv} + \beta_{FamilyAdv*FamilyBr} \cdot FamilyBr_k + \beta_{FamilyAdv*Depth} \cdot Depth_k)}{FamilyAdv_k} (-s_{ij} s_{ik} + 1_{(k=j)} s_{ik}) \quad (12)$$

where, *FamilyAdv* is the advertising effort of the family brand, *FamilyBr* is the breadth of hierarchy of the family brand and *Depth* is the depth of the brand hierarchy.

2.4.2 Accounting for Brand Hierarchy

A typical marketing mix model of individual (product) brand performance relates the performance of brand *j* in period *t* to its price, and other marketing-mix variables such as its promotion, advertising, distribution, and possibly product quality, product features and country of origin:

$$BrandPerf_{jt} = f\left(Price_{jt}, X_{jt}\right) + \varepsilon_{jt} \quad (13)$$

where, Xjt = [$Promo_{jt}$, Adv_{jt}, $Distrib_{jt}$, $Quality_{jt}$, $Features_{jt}$, $Origin_{jt}$] is a vector of characteristics of brand *j* in period *t* (i.e., the X_{jt} from above). In general, brand architecture is not accounted for, and advertising is typically limited to advertising effort by the focal individual (product) brand.

I extend this traditional (or base) model in two ways. First, I account for brand architecture via variables that describe the breadth and depth of the brand hierarchy from the perspective of a focal individual (product) brand. Second, I include variables that capture advertising effort at all levels of the brand hierarchy. That is,

$$X_{jt} = \begin{bmatrix} Promo_{jt}, IndividualAdv_{jt}, FamilyAdv_{jt}, CorporateAdv_{jt}, Distrib_{jt}, \\ Quality_{jt}, Features_{jt}, Origin_{jt}, BreadthOfHierarchy_{jt}, DepthOfHierarchy_{jt} \end{bmatrix} \quad (14)$$

where,

$Promo_{jt}$ = Rebates or incentives for individual (product) brand *j* in period *t*;

$IndividualAdv_{jt}$ = Advertising effort for individual (product) brand *j* in period *t*;

$FamilyAdv_{jt}$ = Advertising effort in period *t* for the brand, if any, one level above individual (product) brand *j*;

$CorporateAdv_{jt}$ = Advertising effort in period *t* for the brand, if any, two levels above individual (product) brand *j*;

$Distrib_{jt}$ = Distribution of individual (product) brand *j* in period *t*.

$Quality_{jt}$ = Product quality for individual (product) brand *j* in period *t*;

$Features_{jt}$ = Product features included in individual (product) brand *j* in period *t*;

$Origin_{jt}$ = Country of origin (or manufacturer) of individual (product) brand *j* in period *t*,

$BreadthOfHierarchy_{jt}$ = Breadth of the brand hierarchy from the perspective of individual (product) brand *j* in period *t*; and,

$DepthOfHierarchy_{jt}$ = Depth of the brand hierarchy from the perspective of individual (product) brand *j* in period *t*.

2.4.3 Measures for Depth and Breadth of a Brand Hierarchy

Breadth of a Brand Hierarchy. I require an operational measure for the breadth of a brand hierarchy. The measure should have two desirable properties: (1) be defined at the parent brand level capturing heterogeneity in the brands below it; (2) for a given number of individual (product) brands, breadth should increase with diversity in the individual (product) brands. I measure diversity across brands based on product-feature similarity, an appropriate measure of fit in feature-oriented situations (Park, Milberg and Lawson 1991). Following Bordley (2003), I segment the auto industry into product-class segments using body style (sedan, hatchback, sport utility vehicle, van, pick-up), size (small, medium, large), and luxury tier (luxury, standard)[2]. I define *s* as a product class segment defined by body style, size, and luxury tier, and n_{sjt} as the number of sub-brands in product class *s* that the parent of brand *j* has in period *t*. Then,

[2] Such product-class segmentation is also used by industry trade publications such as Ward's Automotive and Automotive News.

(15) $$Breadth\ Of\ \ Hierarchy_{jt} = \left[\sum_{s=1}^{S} \left(n_{sjt} \right)^2 \right]^{1/2}$$

Depth of a Brand Hierarchy. I operationalize $DepthOfHierarchy_{jt}$ as the number of levels above the focal individual (product) brand that are emphasized in the firm's advertising. For every brand in the dataset, the parent brand (one level up) was emphasized. For individual (product) brands with distinct family and corporate brands, the corporate brand which is two levels above the focal individual (product) brand was also emphasized. Therefore, $DepthOfHierarchy_{jt}$ takes on a value of one or two.

There are two broad approaches for combining observations where the depth of the brand hierarchy differs. Consider a 3-level hierarchy (GM→Chevrolet→Tahoe) and a 2-level hierarchy (Subaru→Outback) as shown in Table 1. A top-down perspective views Subaru brand advertising as being at the corporate brand level, as is advertising for the General Motors brand. A bottom-up perspective views Subaru brand advertising as being for the Outback's family brand, and thus similar in spirit to Chevrolet brand advertising from the perspective of the Tahoe brand. In the analysis, I examine a model that treats the Subaru brand as being both the family and corporate brand level. Robustness checks include analysis of models from a top-down and bottom-up perspective where corporate brand and family brand advertising expenditures are summed to a single variable I call 'parent brand advertising'. However, in this model, I am unable to identify the moderating effects of depth of brand hierarchy. This is because the depth of brand hierarchy is 2 for individual (product) brands that have distinct corporate and family brand advertising have and 1 for those having only parent brand advertising i.e., there is no variation in this

variable for hierarchies with distinct corporate and family brands and for those with a common corporate and family brand.

2.4.4 Data

To test the effect of brand hierarchy on an individual (product) brand's performance I desire data from a product category where brand hierarchies are an integral component of (at least some) firms' branding strategy, and there is variation in the breadth and depth of the brand hierarchies employed both across firms and over time. I study the U.S. automobile industry (passenger cars and trucks) over an 11-year period 1995-2005 (in quarterly time periods), which has these characteristics.

The dataset examined in this article was developed by merging data from a number of secondary data sources. *Ward's Automotive Yearbook* is an annual publication containing monthly unit sales data by individual (product) brand for all automobiles sold in the U.S. during the previous year. Each yearbook also contains detailed product feature data, manufacturer's list prices, and the corporate (and where applicable, family brand) owner for all individual (product) brands offered for sale in the current model year. I operationalized price as the median list price for all a brand's models in a given year. I used size, horse power and miles per dollar as product attribute information. In addition, I also used dummy variables to indicate whether the individual (product) brand is a car or light truck, sport or non-sport and luxury or regular. I also estimate the random parameters for these variables.

Automotive News is a weekly publication that lists both current dealer and current consumer promotion incentives by brand. Since both types of promotion are most often used in

conjunction with one another (collinear), a composite variable was created as an indicator of whether or not there was any promotion in a quarter. *Automotive News Market Data Book* is an annual publication that lists the number of dealers for a family brand as of January 1. I measured distribution as the number of dealers selling a brand. *Consumer Reports* magazine publishes annual reliability scores for automobiles based on a survey of their members. I used these scores as a composite measure of quality information.

Country-of-origin is often discussed as having a significant effect on quality perceptions and hence market share in automobiles. To account for country-of-origin and manufacturer effects, five indicator variables (GM, Ford, Chrysler, Japan and Europe) were created. Brands outside these three countries/regions are mostly Korean brands, and thus the coefficients for these indicator variables describe market share relative to Korean brands. These variables capture the origin of the individual (product) brand's heritage, irrespective of where the product is manufactured or where the current owner of the brand is headquartered. For instance, Honda's Civic sedan though manufactured in the US is classified as a Japanese brand, while Volvo which is owned by the Ford Motor Company is classified as a European brand.

Major styling changes affect brand market shares in the auto industry (Hoffer and Reilly 1984; Pauwels, Silva-Risso, Srinivasan and Hanssens 2004). Using data from autos.msn.com, I created an indicator variable called generation change. This variable is a trend variable that capture successive introduction of individual (product) brands that have undergone a major styling change.

Advertising effort was operationalized as expenditures, which accounts for both reach and frequency. *TNS Media Intelligence* estimates advertising expenditures by (corporate, family and individual) brand. Each record in the advertising data contains brand name, its legal corporate parent company, and an estimate of the total advertising expenditure for the media monitored by TNS – Media Intelligence. Table 2 provides an example record. The information in the first field was used to identify the brand name. Records lacking an individual (product) brand were coded as being for the listed corporate (e.g., first two records in Table 2) or family brand (e.g., third record from top in the above table). Records that also listed an individual (product) brand, as in the bottom three records in Table 2, were coded as efforts for that individual (product) brand. When a record listed two individual (product) brands as in the fifth record above, the expenditure was attributed to both brands (i.e., 303.9 was coded for CTS and 303.9 was coded for Escalade). In the analysis I also examined other plausible coding for these types of data records and describe these in the robustness checks section. Consistent with prior studies of the auto industry that considered brand advertising (e.g., Bowman and Gatignon 1996; Vakratsas, Feinberg, Bass and Kalyanaram 2004), advertising was national advertising[3].

Price and advertising expenditures were scaled using inflation information from the Consumer Price Index (CPI) and 1995 as the base year. I also use logarithmic transformation of the price and advertising variables to take into account diminishing effects. I add a small value,

[3] The data in the TNS/CMR books is organized alphabetically by brand making it impossible to accurately identify each local dealer and hand type their advertising expenditures into the database. As an alternative, I randomly selected a city from the 20 largest U.S. cities and obtained advertising effort data for all the dealers in this geographic region (this was very time consuming as dealer names change over time). The substantive results presented in this paper do not change if a variable describing this data is included in the model. I do not report the results of a model that includes this data as I only have a partial measure for this variable.

1, before carrying out the logarithmic transformation. While price is measured in dollars, advertising is in thousands of dollars.

As stated above, a brand hierarchy is defined from the perspective of the consumer; it is not the legal structure. Thus, for each observation period I require knowledge of what lower level (sub-) brands were emphasized in the advertising copy and/or distribution strategy of each corporate and family brand. This information is used to code hierarchical linkages involving brands. For example, while General Motors acquired Saab in the first quarter of the 2000 calendar year, it advertised its ownership of Saab in early 2002 (source: Factiva). Because advertising copy data is difficult to compile post-hoc, I identified a linkage if it existed in any of the following three data sources: discussion of advertising campaigns in back issues of *Advertising Age* and *Brandweek*, internet archives of commercials such as Adland.tv, and existence of a data record in the advertising expenditure data for a given corporate brand-family brand pairing. Table 3 lists all brands one level and all brands two levels above the individual (product) brands examined in the study.

Over the 11-year observation window there were 458 unique individual (product) brands. Table 4 lists the number of brands in 1995 and 2005. I removed from the analysis all individual brands that had less than eight quarters of data. While the number of individual (product) brands in the market at any specific point time has grown steadily, the number of corporate and family brands has fluctuated over time due to acquisitions (e.g., GM's purchase of Saab) and family brand (e.g., Plymouth, Oldsmobile) exits. The table also lists the brands with the highest advertising expenditures. While Ford Motor Co. spent the most on corporate brand

communication in 1995, GM's corporate brand advertising efforts increases significantly from the year 2002 (Figure 2) when it focused on changing consumers' attitudes towards the firm (source: Automotive News, May 12, 2003, Monday, Pg. 16M, Jean Halliday). While the Saturn family brand spent the most on advertising in 1995, Chrysler was the dominant family brand advertiser in 2005. At the level of the individual brand, Honda's individual (product) brand Accord spent the most on advertising in 1995. In recent years, Korean brands have spent more money on advertising, and Hyundai's individual (product) brand Sonata was the dominant spender in 2005. There is, therefore, considerable cross-sectional and temporal variation in advertising expenditures across levels of the brand hierarchy. The analysis presented below is based on 314 individual (product) brands and 8,979 observations.

2.4.5 Content Analysis

The theoretical framework for the main and moderating effects of depth of the hierarchy are based on the premise that in a hierarchy with high depth, 1) family brand and individual (product) brand advertising focus on product attributes and hence, there is information redundancy and, 2) corporate brand advertising efforts emphasize abstract associations and hence, evoke associations that are not consistent with those of the family brand.

To check the validity of these assertions, I collected information on the advertising campaigns for brands in my dataset from Factiva. I supplemented this information with data from sources such as Advertising Age and adland.tv. A sample of 100 advertising campaigns for various brands at different levels of the hierarchy was available for the analysis. The procedure

used to capture the content in these advertising campaigns and the results of the analysis are as follows –

- I first recorded the focal brand of the advertising campaign and its level in the hierarchy i.e., corporate, family or individual (product). I used a dummy variable to capture the content of a campaign. While campaigns that focused on product attributes (e.g., price, quality, engineering features and technology) and promotions were coded as 1, campaigns that focused on reputation, social responsibility and customer relationships were coded as 0.
- For firms that have distinct corporate and family brands i.e. high depth of hierarchy, there is a significant difference ($p<0.05$) in the content of advertising campaigns for the corporate brand and the family brand. While family brand campaigns focus predominantly on product attributes (mean = 0.87, s.d. = 0.35), corporate brand campaigns focus more on abstract associations (mean = 0.5, s.d. = 0.53). This is in line with the premise that in a hierarchy with high depth, the corporate and family brands provide inconsistent information.
- Individual (product) brand advertising campaigns focus predominantly on product attributes (mean = 0.92, s.d. = 0.28). The difference in the contents of advertising campaigns of individual (product) brands and distinct family brands is not significant ($p>0.1$). This result lends support to the theoretical framework that in a hierarchy with high depth, family brands individual (product) brands focus on product attributes, resulting in information redundancy.

2.5 Empirical Analysis and Results

Instruments

I assume that the characteristics of the individual (product) brand are exogenous and consequently, not correlated with the error term. This is a reasonable identification assumption because firms would find it difficult to quickly change product characteristics in a short observation period such as a quarter. I also assume that budgets for marketing variables such as advertising and promotions are exogenous and fixed for a quarter, and require a lead time of several weeks for effective implementation. I also do not find any systematic temporal variation in the breadth and depth of the brand hierarchy, and hence consider these variables as exogenous.

Since prices of individual (product) brands are endogenous and are correlated with the error term, I use instrumental variable techniques. Specifically, the set of instruments consist of: 1) all exogenous variables (i.e., other than price and country of origin); 2) the sum of product attributes (i.e., horse power and miles per dollar) of all individual (product) brands belonging to another corporate brand; 3) the sum of product attributes of all individual (product) brands (other than the focal individual (product) brand) belonging to the same corporate brand (corporate brand breadth and corporate brand advertising are dropped since there is no variation within a firm). To refine the set of instruments, I follow an approach similar to Bresnahan, Stern and Trajtenberg (1997) to generate instruments within a subset of individual (product) brands and not for all individual (product) brands in the market. For each individual (product) brand, I create two subsets (i) all individual brands that belong to the same country of origin (ii) all individual brands that belong to the same segment (following Ward's Automotive's classification of

segments). In addition, I similarly compute the sum of individual brands within and outside the firm for the intercept. Using the above procedure, I generate 29+12=41 instruments. These are valid instruments as the competitor brand variables do not enter the demand equation. These instruments explain 73.3% of the variation of price and 82.6% of the variation of log (price). Since I compute the random coefficients for the intercept and three product attributes, there are 29+4=33 parameters estimated in the model.

Market Size

To compute the market potential (size), I used the approach suggested by Sudhir (2001): *Market (potential) Size (t) = (No. of households (t) × Average no. of cars per households) ÷ Average age of cars*. Age of a vehicle was obtained from the Bureau of Transportation Statistics. While the average age of cars increased from 7.7 years in 1995 to 9 in 2005, the average age of light trucks decreased from 7.4 in 1995 to 6.6 in 2005. I obtained data for the average number of vehicles per household from the National Highway Traffic Safety Association (NHTSA). The annual number of households was obtained from the Current Population Survey's March supplement. The number of households increased from 99 million in 1995 to 113 million in 2005.

Robustness Checks

I conducted several robustness checks to ensure the validity of the results. I checked for different functional forms and found that the model with logarithmic transformations of price and advertising variables performed best. I also checked for several other interaction effects, specifically between other marketing mix variables (e.g., price, promotion) and brand hierarchy

variables, and found that they were not significant. Since firms introduce and delete individual brands from their portfolio, I examine the effects of entry and exit of individual brands. I re-estimated the model with only those individual brands that are present for all 44 quarters, and find that the difference in results is not significant. I, however, acknowledge that the study does not explicitly model the entry and exit of individual brands.

Given the limited degrees of freedom available in the data, I was able to estimate heterogeneity coefficients for only a small number of coefficients. I examined a range of models where unobserved heterogeneity parameters for different combinations of explanatory variables were estimated. I found that the estimates for intercept, size, miles per dollar and horse power were consistently significant and present the results with the unobserved heterogeneity parameters for only these four variables.

I also tried including demographic data such as age, income, presence of children less than 16 years of age, and urban or rural location. The estimates of these variables were not significant.. This is probably due to the fact that I have aggregate national data, and hence do not have any variation in these variables across geographical markets. A closer inspection also revealed little temporal variation in the demographic variables. I also varied the number of individuals '*n*' in the simulation from 400 to 1000, and found that the results were stable. The final results are for $n = 400$.

For individual (product) brands that have a common family and corporate brand, I rely on TNS Media's classification methodology to distinguish between family brand and corporate brand advertising. Specifically, I use the 'class' field in the advertising data from TNS Media to

differentiate family brand advertising from corporate brand advertising. As a robustness check, I estimated a model with a combined measure of family and corporate brand advertising. The combined measure has a positive effect on individual (product) brand performance. Since there is no variation in the depth of hierarchy across individual (product) brands, I am unable to estimate its main and moderating effects and therefore, do not report the results for this model.

Summary Statistics

Table 5 presents the pair-wise correlations for the variables. Corporate brand advertising is moderately correlated with distribution, corporate brand breadth and depth. A step-wise introduction of variables into the model revealed significant multicollinearity between distribution and corporate brand advertising. Since corporate brand advertising is one of the focal variables in the study, I drop distribution from the model.

Table 6 presents summary statistics. The average price of an individual brand is $23,599. The average advertising expenditure for an individual brand in a quarter is around $6 million. A family brand spends approximately $13 million on advertising effort in a quarter. The average quarterly expenditure on corporate brand advertising is around $16M. However, there is significant cross-sectional and temporal variation in these expenditures as noted before. While the average quarterly advertising efforts of the family and corporate brands seems higher than that of an individual brand, it is important to realize that firms often have several individual brands. The average reliability score for an individual (product) brand is 3.04. The minimum reliability score is 1 and the maximum is 5 with Japanese brands generally scoring higher than brands from other manufacturers/origins. The promotion variable is a dummy variable indicating

whether the manufacturer offered dealer rebates or ran consumer promotions for the individual (product) brand in that quarter. The innovation variable is a trend variable that changes value the year a new generation of an individual (product) brand is introduced in the market. The average depth of hierarchy for individual (product) brands in the sample is 1.5.

The average value of corporate brand breadth is 8.85. However, there is significant cross-sectional variation in this value. For instance, while Ford has a corporate brand breadth value close to the mean, GM has a higher corporate brand breadth value of around 17, and European manufactures have a much smaller value, close to 2. Japanese firms have a corporate brand breadth just below the average, while Chrysler has a corporate brand breadth just above the average. It should be noted that the operationalized value of corporate and family brand breadth decreases with higher breadth. While most manufacturers compete across multiple product categories, GM has more individual (product) brands within a category than any other corporate brand, and hence has a lower breadth value. The average family brand breadth is 3.8 However, there is significant variation here. The Chevrolet family brand has the highest breadth value of 6.8 indicating that it is the most focused family brand and has the least breadth. Toyota has a family brand breath value of 4.8. US family brands such as Chrysler and Dodge have a value of family brand breadth around 3.9.

2.5.1 Results

The estimates from the analysis are in Table 7. Random coefficients were estimated for the intercept and the three product attributes included in the model to account for brand-specific characteristics, namely, size, horse power and miles per dollar. The coefficient for price is

negative and significant. The coefficients for reliability and generation change are positive and significant as would be expected. Promotions in all four quarters have a positive and significant effect on individual (product) brand performance. The coefficients for the manufacturer and country-of-origin effects are also positive and significant. The coefficients for the dummy variables that indicate whether the individual (product) brand is a car/truck and sport/non-sport are significant, suggesting a preference for non-sport cars. However, the coefficient for the luxury dummy variable is insignificant. Consumers have a significant preference for vehicles that are large in size. Interestingly, the negative significant coefficient for miles per dollar suggests that high gas-consumption vehicles are preferred over frugal ones. The coefficient for horse power is not significant.

Regarding the variables of interest, the individual, family and corporate brand advertising coefficients are all positive and significant. Therefore, advertising efforts at all levels of the brand hierarchy have a significant positive main effect on individual (product) brand performance. The results also suggest that decreasing corporate brand breadth has a positive effect on individual (product) brand performance. This lends support to the theory that with lower breadth, there are greater alignable differences resulting in better recall and higher individual (product) brand performance. While the main effects of family brand breadth and depth of the hierarchy are in the expected direction, they are not significant.

I now look at the results for the moderating effects of brand hierarchy on family and corporate brand communication efforts. Here, contrary to my hypothesis, I find that increasing corporate brand breadth increases the effectives of corporate brand communication efforts on

individual (product) brand performance. This suggests that it serves little purpose to emphasize the abstract associations of the corporate brand when it has a low breadth. The moderating effect of family brand breadth on family brand communication efforts is in the expected direction but not significant. With respect to the moderating effect of depth of hierarchy, I find that increasing depth of the hierarchy reduces the effectiveness of family brand advertising, but increases the effectiveness of corporate brand advertising. This is in line with my theory that information redundancy in a brand hierarchy with high depth plays a significant role in moderating the effectiveness of communication efforts at higher levels of the hierarchy on individual (product) brand performance.

Price Elasticities

I calculate price elasticities to understand substitution patterns within and across family brands in the automobile industry. I perform a bootstrap sampling to compute the average own and cross price elasticities of individual (product) brands belonging to a family brand. I find that the cross price elasticities are significantly lower than own price elasticities suggesting that increases in market share due to price changes occur mostly due to gains in primary demand rather than from individual (product) brand switching. This is because the US automobile industry is highly fragmented (the maximum market share of an individual (product) brand in this study is 4%), and the market share for the outside good is significant (approximately 60% in this study).

I report the elasticities for eight family brands in Table 8. The cross price elasticities reveal interesting insights on competition between different family brands. The performance of

Nissan, Chrysler and Toyota family brands are impacted the most by changes in the price of individual brands from the Hyundai family. Competition between the Korean brands is significant with Kia being affected the most by Hyundai and Hyundai in turn being affected by Kia. Mercury and Chevrolet too are locked head-on with price changes in one affecting the other more than other family brands. Evaluating cross price elasticities is useful for managers as they evaluate the positioning of their brands in the market place and determine who their primary competitors are.

Advertising and Brand Hierarchy Elasticities

Since advertising efforts at all levels of the hierarchy do little to influence individual (product) brand substitution, I focus on own advertising elasticities. The average own individual (product) brand advertising elasticity is 0.1157 (min=0.1129, max=0.1160). This compares well with results from other studies (e.g., Ataman, van Heerde and Mela forthcoming; Hanssens, Parsons and Schultz 2003).

Using equation 13, I compute family brand and corporate brand advertising elasticities and family brand and corporate brand breadth elasticities. I report these elasticities at the level of the family brand in Table 9. The own family brand advertising elasticities are positive for all brands. However, brand hierarchies that have a distinct family brand and hence a higher depth of brand hierarchy, have a significantly smaller net effect from family brand advertising than those with a lower depth of brand hierarchy ($p < 0.01$). This is because in a brand hierarchy with high depth, family brand advertising conveys largely redundant information resulting in its lower effectiveness.

Interestingly, Table 10 reveals that corporate brand advertising elasticities are negative in certain cases. It is important to note here that the elasticities are calculated after taking into account the main and moderating effects of corporate brand advertising. Recalling the results from the estimation, while corporate brand advertising has a positive effect on individual (product) brand performance, its effectiveness is dampened with decreasing breadth of the corporate brand. A comparison of the corporate brand advertising elasticities for individual (product) brands that have a value of corporate brand breadth higher and lower than the average reveals a significant difference ($p<0.01$). Individual (product) brands that belong to firms such as GM, Ford and Toyota have a high value of corporate brand breadth (i.e., low corporate brand breadth). Consequently, they have significantly lower corporate brand advertising elasticities than brands that belong to firms such as BMW, Mercedes and Hyundai. Similarly, the corporate brand breadth elasticities are significantly lower ($p<0.01$) for brands that have higher than average corporate brand advertising expenditures than for those that spend less than the average[4].

The above results now give us a better understanding of which levels in the brand hierarchy advertising efforts should focus on to improve individual (product) brand performance. Focusing on the individual (product) brand level of the brand hierarchy has the highest impact on performance. Emphasizing the family brand level has a lower but positive effect on performance. However, the effect is greater for individual (product) brands that have low depth than for brands that have high depth of brand hierarchy. Finally, firms should emphasize the corporate brand only if they have high corporate brand breadth.

[4] The results are true when using the median values too.

It is important to note that any change in family brand breadth also results in a change in corporate brand breadth. For instance, addition of an individual (product) brand to an existing category lowers the breadth of the family brand, and also lowers the breadth of the corporate brand. While lower family brand breadth results in improved individual (product) brand performance, this effect could be overwhelmed by lower corporate brand breadth for a firm that heavily advertises the corporate brand. Hence, change in both, corporate brand breadth and family brand breadth should be taken into account while evaluating individual (product) brand performance. Using a structural model is extremely useful as it allows us to conduct simulations and evaluate such situations. I explain the procedure in detail in the following section.

2.5.2 Policy Simulations

Since brand architecture plays a significant role in individual (product) performance, natural questions to answer are 1) How do changes in a firm's brand architecture affect the performance of its individual (product) brands? 2) How can advertising efforts be reallocated to improve performance? The current events in the automobile industry provide a fertile ground to conduct such thought experiments. I carry out two policy simulations to understand how changing the brand architecture and reallocating advertising efforts influence individual (product) brand performance.

Scenario 1 - Brand Pruning and Merger Analysis

I use recent news regarding GM's decision to phase out Saab, Saturn and Hummer (source: The Wall Street Journal, February 19, 2009, Kate Linebaugh and Neal Boudette) to make changes to GM's brand architecture. Specifically, I assume that these family brands will

stop competing in the US market. Since there is little information on the Pontiac family brand and its individual (product) brands, I assume that individual (product) brands from Pontiac are merged and sold under the Chevrolet family brand. I also assume that other firms do not react to changes in GM's brand architecture. I use data for all four quarters from 2005 for the analysis. I first calculate the new breadth for the Chevrolet family brand and the GM corporate brand. I then use the estimates from the analysis and predict the market share of the individual (product) brands. I then aggregate the predicted market shares to the family brand level to understand how changes in the brand architecture affect firm performance as a whole.

A priori, it seems that merging individual (product) brands from the Pontiac family with the Chevrolet family would improve the performance of Chevrolet because 1) Individual (product) brands from Pontiac compete largely in the same categories that individual (product) brands from Chevrolet compete in. With the merger, Chevrolet would be more focused, have a lower breadth and consequently improve its performance. 2) Pontiac offered stiff competition to Chevrolet (mean cross price elasticity= 0.0094), which would now be absent. At the corporate brand level, GM's decision to phase out the family brands Saab, Saturn and Hummer would result in fewer individual (product) brands in the categories that it competes in, and hence lower its focus and increase its breadth. I know from the GMM estimation and elasticities that the net effect of higher corporate brand breadth on performance is positive for a firm like GM that spends considerable amounts on corporate brand communication efforts.

The results of the policy simulation are in Table 11. The simulated performance of the Chevrolet family brand far exceeds its actual 2005 performance. I can observe that the gain in

market share for Chevrolet exceeds the gain from the addition of Pontiac brands. The overall market share loss for GM is lower than the market share of its phased out brands. This suggests that GM's market performance is better than one would expect by focusing on four family brands.

Scenario 2 - Reallocating Advertising Efforts

GM recently announced that it would be spending more money on its family brands and 'there would be no advertising on behalf of the GM brand' (source: Reuters, August 11, 2009, Kevin Krolicki). Therefore, in addition to the new brand architecture assumed in the previous simulation, I make a conservative assumption that GM would reallocate 50% of it 2005 corporate brand advertising expenditure to family brand advertising. I also assume that this amount would be equally divided among the four remaining family brands – Chevrolet, Cadillac, Buick and GMC.

The results in Table 11 suggest a further improvement in the performance of the four family brands and a total market share of 23.8% for GM. While increasing family brand advertising efforts was expected to improve performance, lower corporate brand advertising efforts also helps. Sensitivity analysis reveals that increasing reallocation of corporate brand advertising effort to family brand advertising results in even better performance. For instance, increasing the reallocation of GM's corporate brand advertising efforts to its four remaining family brands from 50% to 90% increases GM's overall market share by another 2.2% to around 26%.

2.5.3 Discussion

Strategic decisions regarding brand architecture include the depth (levels) and breadth (distinct brand names at a level) of the hierarchy, and what levels of the hierarchy to emphasize. These strategic decisions guide the research questions I investigate. For the analysis, I use data from a category where there is widespread use of brand hierarchies and significant variation in the strategies adopted by different firms. I use a random coefficients logit model to obtain the estimates and subsequently calculate elasticities for price, advertising and brand hierarchy.

The key findings of this essay are 1) Firms should take into account the breadth and depth of the hierarchy while deciding where to allocate advertising resources. The effectiveness of family brand advertising is lower in a hierarchy with high depth. Corporate brand advertising can improve performance when the corporate brand breadth is high. 2) Changing brand architecture can influence the performance of all individual (product) brands in the portfolio and consequently, the overall performance of the firm. Policy simulations reveal that changes in the brand architecture can compensate for the loss in market share arising from brand deletion. In addition, reallocation of advertising efforts to other levels of the hierarchy can significantly boost individual (product) brand performance. These results are interesting and relevant to academics and managers.

The results of the study hold out to several robustness checks. However, the study is not without limitations, which suggest opportunities for future research. A single industry is examined, though it is one where brand hierarchies are common and their effects have been criticized in the popular press. While future research could examine other industries, there are

implications for data collection. Compiling the dataset analyzed in this research was a very laborious process. A limitation of this study is that the model is static and does not consider the dynamics on the demand side. Future studies can consider other measures such as profitability, factor in costs and estimate a supply model in addition to the demand model. I believe these are interesting areas for future study, but recognize that each has very significant implications for data collection.

3 ESSAY 2: The Impact of Category Incongruity and Extension Typicality on Individual Brand Performance

3.1 Introduction

Firms often extend their brands across categories and within a category. The former type of extensions is commonly referred to as brand extensions and the latter as product line extensions. Within a category, firms have to decide how to position their individual brands. For instance, firms could decide to position a brand close to a competitor or position it some distance away by changing its product attributes. Across categories, firms have to decide the breadth of a parent brand i.e., the number of categories a parent brand competes in and the number of individual brands in each category. The breadth of a parent brand is a key element of brand architecture. These strategic decisions form the basis for this study. In this essay, I develop theory to understand how the position of an individual brand in its category and the breadth of its parent brand influence its performance.

In the brand extension literature, studies have often used the concept of 'fit' to explain brand extension performance. Fit is defined as the similarity of the extension with its parent brand (Aaker and Keller 1990; Boush and Loken 1991). In all these studies, the position of the individual brand in its category is ignored. On the other hand, studies that examine the performance of individual brands within a category fail to take into account the impact of the parent brand's extensions. The aim of this study is to develop and test a unified theory of individual brand performance. The theory is based on the notion that the congruity/incongruity of the individual brand with respect to 1) its category, and 2) its parent brand, impacts its

performance. In addition, the study also examines if there are changes in consumer tastes for within and across category incongruity over time.

I build on work in the consumer behavior and economics literature to develop a clear understanding of individual brand performance. While studies on consumer behavior are primarily based on categorization and information-processing theories (e.g., (Meyer-Levy and Tybout 1989), economic models use location theories developed by Hotelling and Lancaster to explain how incongruity of the individual brand with its category impacts its performance. I also clarify the process through which extensions of the parent brand impacts individual brand performance. I adopt a novel approach to test my theory using secondary data from the consumer packaged goods industry.

I used a random coefficient logit model to analyze four different product categories – household cleaner, liquid laundry detergents, yogurt and toothpaste. Results support theories from both consumer behavior and economics domains. The effects of within-category incongruity depend largely depend the marginal value that consumers gain from increasing product differentiation. If the marginal value from increasing incongruity is diminishing, consumers prefer products that are moderately incongruent – in line with theory from the behavioral literature. On the other hand, when the marginal value from increasing incongruity is increasing, consumers prefer products that are wither extremely congruent on extremely incongruent– in line with location theory from economics. The effect of across category extensions too varies across product categories. An interesting result observed across all four categories studied is that the effects of category incongruity and parent brand breadth change

over time. A possible explanation is that over time, consumers try out various alternatives and gain experience with the category.

The study is organized as follows. First, I briefly review previous work on within-category competition and brand extensions. I then present my conceptual model that explains how a brand's performance is affected by its position in its category and extensions of the parent brand. Here, I also develop the *Incongruity-Typicality Matrix* to give us a better understanding of the drivers of brand performance. I then specify the research design consisting of the model, data and operationalizations of the variables. The essay concludes with a discussion of the results and potential implications.

3.2 Background

3.2.1 Within-Category Competition

The question of how consumers make choices when faced with a set of competing brands has long fascinated marketing managers and scholars. Using a demand logit model, substitution patterns can be explained by projecting consumer preferences onto a set of product attributes (Dube et al. 2002). Fader and Hardie (1996) study the fabric softener segment and find that their model outperforms those that do not consider stock-keeping-unit (SKU) attributes. While conjoint analysis has been widely used to understand how consumers make trade-offs, Rao (2008) suggests conjoint studies should now incorporate learnings from consumer behavior literature, specifically in the fields of information processing and choice. This study contributes to the literature as it tests competing theories from consumer behavior and economics to explain

how the within category position of an individual brand, based on the combination of its product attributes, affects its performance.

In the consumer behavior literature too, the subject of brand choice is of great interest. An interesting concept in this literature is the attraction effect (Huber, Payne and Puto 1982). The attraction effect suggests that adding an option that is dominated by only one alternative in the original set can increase the preference for the dominating option. Dhar and Simonson (1992) show that making an alternative the focal option increases its attractiveness and choice probability. In another study they (Dhar and Simonson 2003) show that the introduction of the no-choice option strengthens the attraction effect, weakens the compromise effect, and decreases the relative share of an option that is "average" on all dimensions. Recent work in the consumer behavior literature has focused on how the nature of attributes in a product impacts its choice probability under different contexts. Chernev (2004) finds that a product with equal attribute ratings is the preferred choice even when it is not the middle option. In another interesting study, Chernev (2007) found that when brand attributes have different ratings, the option with common features and the most important attribute gains share. On the other hand, common features equalize brand shares when the attributes have equal ratings. Different from these studies, I examine how the incongruity of an individual brand with respect to its category impacts its performance.

3.2.2 Across-Category Brand Extensions

Most studies in the brand extension literature examine the extension of a parent brand across categories in an experimental setting (e.g., Aaker and Keller 1990; Boush and Loken

1991; Klink and Smith 2001; Park, Milberg and Lawson 1991). The variable of focus in all these studies is the fit of the extension with the parent brand. To measure fit, studies (e.g., Bottomley and Doyle 1996; Bottomley and Holden 2001; Echambadi, Arroniz, Reinartz and Lee 2006; Sunde and Brodie 1993) use the three measures of fit conceptualized by Aaker and Keller (1990), namely, transfer of skills from parent brand to extension, complementarity and substitutability. However, these studies have found widely differing results for the impact of each of these factors on consumer evaluations of brand extensions. Klink and Smith (2001) survey subjects in an experiment to evaluate the fit or perceived similarity between an extension and its parent brand. They find that the effect of fit on consumer evaluation of the extension diminishes in the presence of other factors such as greater product related information and greater exposure to the extension. Volckner and Sattler (2006) conduct a survey in Germany and ask consumers to evaluate the fit between an extension and its parent brand based on factors conceptualized by Broniarczyk and Alba (1994). They find that fit is the most important driver of brand extension success. In all these studies, the position of the individual brand within its category is not considered.

There also exist studies on brand extensions that do not examine fit specifically, but investigate the spillover effects of umbrella brand[5] extensions. Studies using analytical models (Montgomery and Wernerfelt 1992; Wernerfelt 1988), suggest that umbrella brands reduce consumers' uncertainty about product quality. Using scanner panel data of toothpaste and toothbrush categories, Erdem (1998) provides empirical support for this theory. In another study, Erdem and Sun (2002) find that there exist significant spillover effects in the marketing variables

[5] An umbrella brand, as defined in Essay 1, refers to using the same brand name in multiple product categories.

of umbrella brands in the toothpaste and toothbrush categories. They also find that advertising reduces the variance in consumers' utilities, adding support to the theory that advertising reduces consumers' perceived risk. However, studies on umbrella branding typically consider just a few related categories and again, do not consider the position of the brand in its category.

3.3 Theoretical Development

3.3.1 Within-Category: Category Incongruity

Studies in the consumer behavior and economics literature have examined how the position of a brand with respect to its competitors in the category plays an important role in consumer evaluations of the brand and consequently, its performance. While studies on consumer behavior are primarily based on categorization and information-processing theories, economic models use location theories developed by Hotelling and Lancaster. Building on existing work in these two domains, I develop theory to explain how the location of a brand with respect to its competitors in the focal category affects its performance. Interestingly, the theories from consumer behavior and economics literature offer contrasting hypotheses as seen below.

Within-Category Effects based on Consumer Behavior

Schemas are cognitive structure representing one's expectations about a domain (Bettman 1979). The expectations include hypotheses about the values on attributes, importance weights of attributes and how much variability there is across brands on attributes. Schema congruity theory as proposed by Mandler (1982) suggests that the extent of similarity or dissimilarity of a product's attributes with the product's category schema plays a vital role in consumers' evaluations of the focal product.

According to Mandler, when a product is highly consistent with the consumer's category schema, it is unlikely to prompt extensive elaboration. In such cases, consumers' evaluation of the product though positive, is mild and not extreme. As the incongruity of the product with the category schema increases, greater cognitive elaboration is needed to resolve the incongruity. Moderate incongruities are differences that can be resolved without change in the consumer's existing cognitive structure, either through assimilation, sub-typing or activation of an alternate schema. On the other hand, an extreme incongruity can be resolved only through fundamental changes in the consumer's existing cognitive structure.

Schema incongruity theory suggests that consumers would find resolving moderate incongruities "interesting and positive valued" and experience higher positive affect. However, resolving extreme incongruities requires greater cognitive effort, resulting in greater negative affect and lower likelihood of the difficult alternative being chosen (Garbarino and Edell 1997). Hence, products that are moderately incongruent with the category schema have higher consumer evaluations than extremely congruent or incongruent products. Studies on the compromise effect (e.g., Simonson 1999) also provide theoretical support for such inverted U-relationships. As the marginal value of increasing incongruity diminishes, consumers' prefer products that are moderately incongruent to those that are either extremely congruent or incongruent. In other words, the marginal value that consumers gain from resolving these incongruities is diminishing.

Therefore, brands that are moderately consistent with their product category would perform better than those that are highly congruent or incongruent with respect to their product

category. In other words, I expect an inverted U-shaped relationship between category incongruity (on the x-axis) and brand performance (on the y-axis). If the performance of brand *j* in category *C* at time *t* is denoted as s_{jct}, and the incongruity of a brand with its category is d_{jct}, then $\frac{\partial s_{jct}}{\partial d_{jct}} > 0$ and $\frac{\partial s_{jct}}{\partial d_{jct}^2} < 0$.

Within-Category Effects based on Location Theory

Hotelling's (1929) theory of minimal differentiation suggests that a pure strategy Nash Equilibrium exists where firms locate closer to each other and towards the mid-point of the Hotelling line. Economists have extensively tested this theory and found it to be true under various conditions, such as consumption externalities (Ahlin and Ahlin 2006) for snob (e.g., comparison shopping of luxury brands) or congestion goods (e.g., queuing at the restaurant), linear transportation costs (D'aspremont, Gabszewicz, and Thisse 1979) and Cournot competition (Anderson and Neven 1991; Shimizu 2002). In the presence of Bertrand competition, Dasgupta and Maskin (1986) and Osborne and Pitchik (1987) show that Hotelling's theory is feasible in a mixed-strategy equilibrium. Anderson and Neven (1991) note that it is common for products to agglomerate in space.

Studies have also shown that firms or products locate far away from each other. For instance, D'aspremont et al. (1979) suggest that when the consumer incurs quadratic transportation costs, the equilibrium consists of the firms locating at the two extremes of the Hotelling line i.e., maximal differentiation. A similar result is found in studies using Salop's circle where competing firms or substitute products are located as far as possible from each other

(Pal 1998; Shimizu 2002). For example, in the case where there are N brands in a Salop's circle, the distance between brands is the maximum possible 1/N (Salop 1979).

Results from the above studies suggest that (under varying conditions), the equilibrium is either spatial agglomeration due to minimal differentiation or spatial dispersion due to maximal differentiation. In other words, a brand's performance decreases as it moves away from minimal differentiation and increasingly differentiates itself from its competitors, i.e., its incongruity increases, and then increases with maximal differentiation. Building again on work on the compromise effect, a U-shaped relationship exists because the marginal value that consumers gain from increasing differentiation i.e., increasing incongruity is increasing. Therefore, if the performance of brand *j* in category *C* at time *t* is denoted as s_{jct} and the incongruity of a brand with its category is d_{jct}, then $\frac{\partial s_{jct}}{\partial d_{jct}} < 0$ and $\frac{\partial s_{jct}}{\partial d_{jct}^2} > 0$.

3.3.2 Across Category: Brand Breadth and Extension Typicality

Since there is little consensus from past work on the relationship between fit of the brand extension and its performance (e.g., Volckner and Sattler 2006; Echambadi et al. 2006), I first review extant work to understand how consumers evaluate the fit of a brand extension and its impact on consumer attitudes.

Boush and Loken (1991) define a narrow brand as one that is present in a few categories and a broad brand as one that is present in many categories. They observe that when a narrow brand extends in a similar category, consumers regard the extension as typical. However, when a narrow brand extends into a dissimilar category, consumers regard the extension as atypical. Also, when a broad brand extends in a similar category, consumers again regard the extension as

typical. Boush and Loken also suggest that while typical extensions are judged to be a good fit with the parent brand, atypical extensions are not. In addition, they find a positive relationship between increasing typicality and consumer attitudes.

I build on the above results to develop my hypothesis. The extensions of a parent brand that competes in very few categories and hence, has low breadth would be considered typical. Consequently, consumers' attitudes towards the extension will be positive resulting in high performance. Similarly, the extensions of a parent brand that competes in many categories and hence, has high breadth would be considered typical and have high performance. However, when a parent brand is moderately extended, consumers consider its extensions atypical and have an unfavorable attitude towards the extension. Therefore, extensions of parent brands that have moderate breadth have lower performance. To summarize, extremely high or low breadth of the parent brands results in superior performance of the extension while moderate breadth of the parent brand results in lower performance (see Table 12). If the performance of the focal brand *j* in category *C* at time *t* is denoted as 's_{jct}', and the breadth of the parent brand is 'b_{jct}', then $\frac{\partial s_{jct}}{\partial b_{jct}} < 0$ and $\frac{\partial s_{jct}}{\partial b_{jct}^2} > 0$.

3.3.3 Incongruity-Typicality Matrix

To explain the results for category incongruity and brand breadth, I first create a 2x2 matrix *Incongruity-Typicality Matrix* (Figure 3) to consider possible combinations of estimates for category incongruity and brand extension typicality. I discuss the features of the four quadrants starting from the top left quadrant and moving in a clockwise fashion

Middle path: In this upper left quadrant, product brands perform best within their category when they are moderately congruent from the category schema. Here, the marginal value diminishes as a brand increases its incongruity from the category schema. Also, product brands perform better when their parent brand competes in moderately few related categories.

Differentiation with moderation: In this quadrant, products either closely represent the category schema or significantly differentiate themselves. Moderate incongruence from the category schema leads to lower performance. Here, marginal value from increasing differentiation is increasing. Also, moderate breadth of the parent brands helps the performance of its product brands.

All or little: In the lower right quadrant, products that are either significantly consistent with the category schema or are well differentiated perform better than products that are moderately incongruent. The gains to firms from increasing product differentiation are, therefore, increasing. The categories in this quadrant too should see lower levels of competition when there is maximal product differentiation. Firms can also choose a suitable extension strategy for the parent brand – either focus on a small number of categories or extend across several product categories.

Moderation with extremism: Products that are moderately incongruent with the category schema perform better than highly congruent or incongruent brands. This quadrant is therefore characterized by diminishing returns to increasing product differentiation. Also, consumers regard extensions of the parent brand as typical only if the parent brand is focused on the category or competes in several product categories. Extensions of a parent brand that has moderate breadth are considered atypical. While a firm could extend its parent brand across

categories, the costs involved in such an expansion coupled with decreasing returns from product differentiation puts the firm in a difficult situation. On the other hand, consumers' preference for parent brands that compete in few product categories and moderately incongruent products can result in higher levels of competition.

It is possible that over time, individual brands move from one quadrant to another. The introduction and exit of product brands in the category can lead to shifts in category schema and change the extent of incongruity of a product brand from the schema. It is also possible that over time, the parent brand competes in fewer or larger number of product categories resulting in consumers re-evaluating the typicality of its extensions. However, the data used for the analysis are strongly balanced and there are few extensions of the parent brand in the time period of this study. It is, therefore, possible that over time consumer preferences evolve as they collect information, try alternative brands and then choose brands that maximize their utility (Heilman, Bowman and Wright 2000). For instance, consumers might initially prefer a product that is highly congruent with their category schema. As they gain experience with the product category, they switch their preference for a product that is moderately or highly incongruent with their schema. By including include time varying parameters in the model, I show how consumers' preferences for products change over time and across categories.

3.4 Research Design

3.4.1 Model Specification

As in Essay 1, I use the flexible random coefficients logit model of demand that models the heterogeneity in consumer preferences and also tackles the issue of price endogeneity prevalent in market-level data. I follow the estimation approach suggested by Nevo (2001).

Consumer *i* faces a choice of *J* individual (product) brands in period *t* and an outside good *j=0*. A utility maximizing consumer solves the optimization problem:

(16) $$\max_{j \in (0,\ldots,J)} u_{ijt} = \alpha + \sum_k x_{jkt}\beta_k + \xi_{jt} + \sum_k \sigma_k x_{jkt}\upsilon_{ik} + \varepsilon_{ijt}$$

where, u_{ijt} is the utility of individual (product) brand *j* to consumer *i* in period *t*. x_{jkt} is the k^{th} observed characteristic in vector X_{jt}. Specifically, X_{jt} comprises of marketing mix variables such as price, feature, display, promotion and advertising. In addition it also consists of the focal variables - category incongruity and brand breadth, for brand *j* in period *t*. ξ_{jt} is the unobserved product quality. ε_{ijt} is the random utility across individual (product) brands and consumers and is assumed to be distributed i.i.d. Type1 extreme value. Consumer *i* gains $x_{jkt}(\beta_k + \sigma_k\upsilon_{ik})$ from characteristic x_{jkt}. While $\beta_k x_{jkt}$ represents the average utility to all consumers from characteristic *k*, $\sigma_k v_{ik} x_{jkt}$ represents the deviation for consumer *i* from that average. I assume that υ is drawn from a standard normal distribution and σ_k is the standard deviation in the utility that consumers get from characteristic *k*.

The utility for the outside good, assuming $Price_{0t} = 0$ and $x_{0t} = 0$, is:

(17) $$u_{i0t} = \xi_{0t} + \sigma_0 \nu_{i0} + \varepsilon_{i0t}$$

The outside good captures utility from products other than the individual (product) brands. The heterogeneity in valuation of the outside good is captured through $\sigma_0 \nu_{i0}$. ξ_{jt} is the component that is unobservable to the researcher, but observable to the firm and the consumer, and therefore influences prices.

The utility equation can be decomposed as:

(18) $$U_{ijt} = \delta\left(Price_{jt}, X_{jt}, \xi_{jt}, \theta_1\right) + \mu\left(X_{jt}, \nu_i, \theta_2\right) + \varepsilon_{ijt} = \delta_{jt} + \mu_{ijt} + \varepsilon_{ijt}$$

where $\theta_1=(\beta_1,\ldots, \beta_k)$ is the set of parameters associated with consumer independent characteristics, $\theta_2=(\sigma_1,\ldots,\sigma_k)$ is the set of parameters associated with consumer characteristics $\upsilon_1=(\upsilon_{i1,\ldots,} \upsilon_{ik})$. Therefore, $\delta(.)$ is a function independent of consumer characteristics while $\mu(.)$ is dependent on consumer characteristics.

This leads to the well-know logit formula for the probability of household *i* buying individual (product) brand *j* in period *t*:

(19) $$s_{ijt} = \frac{\exp\left(\delta_{jt} + \mu_{ijt}\right)}{1 + \sum_{m=1}^{J} \exp\left(\delta_{mt} + \mu_{imt}\right)}$$

Hence, the market share of brand *j* in period *t* is:

(20) $$s_{jt} = P = \int_{\nu} \frac{\exp\left(\delta\left(Price_{jt}, X_{jt}, \xi_{jt}, \theta_1\right) + \mu\left(X_{jt}, \nu_i, \theta_2\right)\right)}{1 + \sum_{m=1}^{J} \exp\left(\delta\left(Price_{mt}, X_{mt}, \xi_{mt}, \theta_1\right) + \mu\left(X_{mt}, \nu_i, \theta_2\right)\right)} \, d\nu$$

where $P(\upsilon)$is the joint distribution over all the elements of υ_i=(υ_{i1}, …, υ_{ik}). Since the integral of the above equation has no closed form, simulation is used to compute an approximation of the market share of individual (product) brand j in period t. I draw n vectors of υ_i from $P(\upsilon)$ and obtain an approximation of the above integral:

(21) $$S_{jt} = \frac{1}{n}\sum_{i=1}^{n} \frac{\exp\left(\delta_{jt} + \mu\left(X_{jt}, \nu_i, \theta_2\right)\right)}{1 + \sum_{m=1}^{J} \exp\left(\delta_{mt} + \mu\left(X_{mt}, \nu_i, \theta_2\right)\right)}$$

Since ξ_{jt} is correlated with price, I use an instrumental variables approach to solve the endogeneity problem. I first use Berry et al.'s (1995) contraction mapping theorem to solve for:

(22) $$\delta_{jt}^{h+1} = \delta_{jt}^{h} + \ln\left(S_{jt}\right) - \ln\left(s\left(Price_{jt}, X_{jt}, \delta_{jt}^{h}, P_n; \theta_2\right)\right)$$

where S_{jt} is the observed market share and $s(.)$ is the computed market share from the equation. Since using log forms can speed up the computation process Nevo (2001), I actually solve for $\omega_{jt} = exp(\delta_{jt})$ with the following contraction mapping theorem:

(23) $$\omega_{jt}^{h+1} = \omega_{jt}^{h} \frac{S_{jt}}{s\left(Price_{jt}, X_{jt}, \delta_{jt}^{h}, P_n; \theta_2\right)}$$

The demand side errors conditional on θ_2 can now be computed as,

(24) $$\xi_{jt} = \delta_{jt}\left(\theta_2\right) - X_{jt}\theta_1 .$$

Following Berry et al. (1995), I use GMM procedure for the estimation. If Z is the set of instruments, and is exogenous and independent of the error term in the demand equation ξ, $E(Z'$

$\xi)=0$. This serves as the moment condition in the procedure. Therefore, if θ is the vector of parameters to be estimated,

(25) $$\hat{\theta} = \underset{\theta}{\arg\min}\ \xi' Z \Phi^{-1} Z' \xi$$

where, Φ is a consistent estimate of E($Z \xi\ ' \xi Z'$).

3.4.2 Data

I collected data from various sources for the analysis. The time period for the analysis is five years, from 2001 to 2005. I use weekly sales, price, feature and display information from the IRI Academic dataset (Bronnenberg, Kruger and Mela 2008). I aggregate weekly data across stores to the national level. This dataset also has information on product attributes, which I use to compute category incongruity. Since there is information only on thirty product categories in this dataset, it is difficult to measure brand breadth. I, therefore, use data from the IRI Builders database since it captures information on the various product categories that a parent brand competes in. I use advertising data from TNS-Media Intelligence (now a part of Kantar Media) to capture advertising effort of the focal brand, extensions in the same category and extensions in other product categories.

I consider information on sales promotions as exogenous. This is a reasonable assumption as promotions are often planned well in advance for effective implementation (Chintagunta 2002). I also consider advertising as exogenous. This is because I use weekly data for the analysis and decisions on advertising are often made for a longer time period. For the same reason, I also consider product attributes and hence, category incongruity and brand

breadth exogenous. To control for price endogeneity, I follow an instrumental variables approach similar to Berry et al. (1995). I use 1) all exogenous variables 2) the sum of exogenous variables of other brands of the same parent brand and 3) the sum of exogenous variables of brands of other parent brands as instruments. I also use the number of other brands of the same parent brand and number of brands of other parent brands as instruments.

I use data from four product categories for the analysis – household cleaner, liquid laundry detergents, toothpaste and yogurt. Table 13 displays some of the characteristics of these four product categories in 2003. As is evident, there is wide variation in the number of alternatives and shopping patterns across these categories. Since data in all four categories are strongly balanced, I do not account for specific entry and exit. I consider sales of a product variant or SKU for each week as an observation. The weekly market size for each category at the national market is (Annual household volume * no. of households * 7) / (no. of days in the year). The annual household volume is extracted from the IRI Builders database. The number of households is the year-end figure obtained from the 2009 Census Statistical Abstract. This helps me compute the market share of each product variant and that of the outside good.

Independent Variables

Price - I use information on units sold, the volume equivalent of each unit sold and the total dollars sold to compute the price per unit sold. Total dollars is the average retail price and includes retail coupons though it excludes manufacturer coupons. I first standardize the volume for various product variants, aggregate sales in units and dollars across stores to the national level and then calculate the price.

Feature – At the weekly store level, feature is coded as 1 or 0 to indicate the presence or absence of a feature promotion in a store for a certain product variant. Aggregating the data to the national level, $feature_{jt}$ for SKU *j* in week *t* is the proportion of stores that run a feature for that SKU in that week.

Display – $Display_{jt}$ is the proportion of stores that have a display for SKU *j* in week *t*. Display in the IRI Data is coded as 0 (no display that week), 1 (minor display) or 2 (major display). Examples of major displays are lobby and end-of-aisle displays. Therefore, it is possible that the display measure for a SKU in week *t* exceeds one.

Promotion – A temporary price reduction (TPR) of more than 5% is considered by IRI as a promotion. $Promotion_{jt}$ is measured as the proportion of stores that run a promotion for SKU *j* in week *t*.

Advertising – I use advertising expenditure data from TNS – Media Intelligence to measure advertising effort. Since, information on advertising is at the brand-level and not at the SKU-level, I allocate the brand's advertising effort to all SKUs of the brand. Since I have advertising effort at the monthly level, I assume that brands allocate their advertising budgets evenly and disaggregate data to the weekly level (Jedidi, Gupta and Mela 1999). As noted before, I capture advertising effort of the focal brand *'Own* adv_{jt}*'*, other extensions in the same category *'Same category* adv_{jt}*'* and effort of extensions in other product categories *'Different category* adv_{jt}*'*(see Table 14).

Category Incongruity – I use attribute information to measure the extent a SKU is incongruous with its category. I first use dummy variables to indicate the presence and absence of attributes in

SKU *j* in week *t*. The mean of each attribute provides the coordinates for the centre of the category in week *t*. Category incongruity $congruity_{jt}$ is the Euclidean distance of the SKU from the centre of the category. To check for non-linear effects, I use the squared values of this measure.

Brand Breadth – As in Essay 1, I develop a measure for breadth for brand *j* tha*t* takes into account both, the number of categories the parent brand competes in and the number of individual brands in each category. Therefore, the breadth for brand or product variant *j* whose parent brand is extended across *S* categories, with *n* individual brands in category *s* in week *t* is –

(26) $$Brand\ \ Breadth_{jt} = \left[\sum_{s=1}^{S}\left(n_{sjt}\right)^{2}\right]^{1/2}$$

To check for non-linear effects, I use squared values of this measure.

3.5 Empirical Analysis and Results

3.5.1 Robustness Checks

As part of the analysis, I conducted several robustness checks to ensure validity of the results. I first tried various functional forms and found that the log-linear form fit the data best. I also introduced interaction effects between the focal variables of the study and the marketing mix variables. However, introduction of interaction effects in the model led to severe cases of multicollinearity. The interaction effects were, therefore, dropped from the model. I also check if the results change when category schema is represented as an exemplar or the pioneer. For the household cleaner category, I use the product variant with the highest market share as the exemplar and compute the congruity of other brands in the category with respect to the exemplar.

A web search indicated that the Pine Sol brand is the pioneer of the household cleaner category. Since I had little information on the product variant (e.g., size, fragrance, additives, concentration etc.), I use the largest selling product variant from the Pine Sol family as the pioneer and recalculate category incongruity. Pair wise correlations between the measure used in this study and the two alternative measures are low. However, models using measures of exemplar and pioneer as category schema did not change the results significantly. I, therefore, report only the results from models that use my measure of category schema, i.e., center of the category.

It is possible that consumers differentiate between different sub-categories belonging to the same category. To elaborate, it is possible that consumers measure the incongruity of product variants with respect to the schema of the sub-category and not the overall category schema. I, therefore, use a subset of product variants from the household cleaner category belonging to the product type 'all-purpose'. I recalculate the incongruity measure and estimate the model. Again, there is no significant change in the results.

Preliminary analysis revealed that the coefficients of category incongruity and brand breadth change with time. Therefore, I interact these variables with year dummies to estimate the coefficients for these variables for each of the five years in the data. While I could estimate the coefficients at finer time periods, it would greatly increase the computational complexity. I also estimate random parameters for only the intercept, price, display and feature variables. Random parameters for other variables were either not significant or greatly increased the computational complexity. The model is, therefore, an attempt to balance model flexibility and computational

feasibility. I also introduced variables for product variant introductions and exits. However, introducing these variables did not change the estimates for other variables. To account for macro-economic shocks, price and advertising variables were scaled using inflation information from Consumer Price Index (CPI) with 2001 as the base year. The results were stable with the addition of this variable too.

3.5.2 Results

Table 15 lists the characteristics of market leaders in the household cleaner category. While there is no change in the top two positions for all five years of the study, there are changes in the third position. While there is some temporal variation in the incongruity and breath measures, cross-sectional variation is more significant. The other categories too have similar characteristics. This is evident in Table 16 which lists the summary statistics for the focal variables for all four categories over time. Price shows a decreasing trend in the household cleaner and toothpaste category. Feature and display measures show little variation over time. On an average the household cleaner category spends significantly more on advertising than other categories. The toothpaste category shows some temporal changes in the brand breadth measure. Introductions of new product variants results in a higher value of brand breadth.

The results of the estimation for all four product categories are in Table 17. I first look at the coefficients for the marketing mix variables. The coefficient for price is negative and significant for all product categories. Feature has a significant positive impact in the laundry and toothpaste categories. Display has a significantly positive impact in all four product categories. The coefficients for advertising reveal several interesting insights. Advertising of the focal brand

has a significant positive effect only in the household cleaner category. Interestingly, while advertising effort of other extensions in the same category as that of the focal brand has a positive effect in the yogurt category, advertising effort of other extensions in the same category has a negative effort on the focal brand. This suggests that while extensions in the yogurt category act as complements (Harlam and Lodish 1995), extensions in the toothpaste category behave like substitutes. Also, advertising effort of extensions in other categories has a negative effect on the focal brand's performance in the household cleaner category. This suggests that advertising spillovers from extensions in other categories can be positive or negative, depending on whether the categories are complements or substitutes.

I now look at the effects of the focal variables – category incongruity and brand breadth for each of the four categories. I also attempt to classify the results based on the 2x2 matrix developed in the theoretical framework section.

In the household cleaner category, superior performing products are those that that are either highly congruent or highly incongruent with the category schema. The category exhibits increasing marginal value for increasing product differentiation for all five years of the study, thus lending strong support for location theory. Consumers initially preferred products belonging to parent brands that focused on the household cleaner category. Over time, they also developed a preference for products belonging to parent brands that competed in a large number of product categories. Parent brands that compete in a moderate number of product categories did not help the performance of their product brands. The household category clearly displays properties characteristic of quadrant 3 *All or little* in the *Incongruity-Typicality Matrix* (Figure 3).

Results for the liquid laundry detergent category reveal a significant but decreasing inverted U-shaped relationship between brand breadth and product brand performance. Consumers indicate a strong preference for products belonging to parent brands that compete in a moderate number of product categories. On the other hand, estimates for within category incongruity vary considerably over time. Here, consumers prefer products that are highly incongruent or moderately incongruent with the category schema. The laundry detergent category therefore seems to oscillate between quadrant 1 *Middle path* and quadrant 2 *Differentiation with moderation*. Summary statistics for the category (Table 14) show that there is little deviation in the mean and standard deviation of category incongruity measure over time. Hence entry and exit of brands in the category does not seem a likely reason for consumers' shifting preferences. However, the fact that the category has low consumer loyalty (Table 12) lends support to this result. Data for a longer period of time and at the individual level could possibly reveal if consumers' tastes stabilize over time. This is an interesting area for future research.

The yogurt category shows consumers' increasing preference for products belonging to parent brands that either focus on few categories or extend across a large number of product categories. However, the effects of within-category incongruity are significant for only the second and third years of the analysis. The estimates for these years reveal a preference for products that are moderately incongruent from the category schema, in line with Mandler's (1982) schema incongruity theory. The yogurt category, therefore, would fall in quadrant 3 *Moderation with extremism*.

The toothpaste category shows consumers' increasing preference for products belonging to parent brands that compete in a moderate number of product categories. Presumably, parent brands in the toothpaste category that compete in related oral care categories such as mouthwash, dental floss and toothpaste perform better than parents brands that are focused solely on the toothpaste category or parent brand that competes in large number of other categories. This could explain the ascent of the Crest parent brand and the decline of the Colgate parent brand in the toothpaste category. The estimates for category incongruity too change over time. Overall, consumers prefer products are highly or moderately congruent with the category schema. Therefore, marginal value from increasing product differentiation in this category is diminishing. The toothpaste category, therefore, belongs to quadrant 1 *Middle path*.

3.5.3 Discussion

This study makes an important contribution to the marketing literature for the following reasons. It first tests competing theories from consumer behavior and economics to explain how category incongruity impacts individual brand performance. Second, it clarifies the process through which fit of the individual brand with its parent brand affects its performance in a non-linear fashion. I also developed a framework to understand how within-category and across-category affect performance of brands, in particular the performance of product variants. The framework can help academic and managers gain a deeper understanding of the drivers of brand performance.

The study conducted several robustness checks to ensure validity of the results. Four product categories – household cleaners, liquid laundry detergents, toothpaste and yogurt were randomly selected from ten product categories available for analysis. Table 18 lists the reasons

why the remaining twenty categories in the IRI Academic Dataset were unsuitable for analysis. Estimates from the analysis of these four product categories offer support for theories from the behavioral and economics domains, but under certain conditions. Within-category effects are dependent on the consumers' perception of the marginal value gained from increasing category incongruity. Categories like toothpaste and yogurt revealed diminishing returns from increasing incongruity, lending support to Mandler's schema incongruity theory. On the other hand, the household cleaner category revealed increasing returns from product differentiation, lending support to location theory from economics. With regard to across category effects , while yogurt and household cleaner product variants benefit from either extremely low or extremely high breadth of the parent brand, toothpaste and liquid laundry detergent variants benefit from moderate extensions of the parent brand. An interesting result is that within-category and across-category effects change over time. Within a category, as consumers gain experience with the category and various alternatives, they build preference for product variants. Also, consumers' evaluations of the typicality of an extension with its parent brand vary over time.

This essay is an ideal stepping stone for future studies that seek to answer questions on within and across-category effects. With increasing availability of longitudinal data on the traits and shopping patterns of individual consumers, investigating the underlying behavior for shifting tastes is an interesting area for future research. Studies can also take into account the effect of new brand extensions on consumers' attitudes towards the focal brand. For instance, studies can examine if consumers' initial attitude towards an atypical extension remain stable over time. Future studies can also consider associations between different product categories e.g.,

substitutes or complements, that a parent brand competes in. On the whole, studying within and across-category effects is a promising area for future research.

Table 1

Observations with Different Depth of a Brand Hierarchy

	3-Level Hierarchy	**2-Level Hierarchy**		**Hierarchy Level**
		Top-Down Perspective	Bottom-Up Perspective	
Corporate Brand	General Motors	Subaru	-	Level 3 (corporate)
Family (master) Brand	Chevrolet	-	Subaru	Level (parent)
Individual Brand	Tahoe	Outback	Outback	Level 1

Table 2

Example Data Records from the Raw Advertising Data (Q1 2003)

Brand	Parent Company	10-Media YTD $(000)
GENERAL MOTORS CORP CP	GENERAL MOTORS CORP	335.6
GENERAL MOTORS CORP VIGNETTE	GENERAL MOTORS CORP	96.2
CADILLAC AUTOS VAR	GENERAL MOTORS CORP	350.8
CADILLAC AUTOS SEVILLE	GENERAL MOTORS CORP	242.2
CADILLAC AUTO&TRK CTS & ESCALADE	GENERAL MOTORS CORP	303.9
CADILLAC DLR ASSN SEVILLE	GENERAL MOTORS CORP DLR ASSN	86.3

Table 3

Parent Brands in the Dataset

Brands Two Levels Above an Individual (product) Brand	Brands One Level Above an Individual (product) brand	
BMW*	Acura	Lincoln
Chrysler*	Alfa Romeo	Lexus
DaimlerChrysler	Audi	Mazda*
Ford*	BMW*	Mercedes-Benz*
General Motors (GM)	Buick	Mini Cooper
Honda*	Cadillac	Mitsubishi*
Isuzu*	Chevrolet	Nissan*
Kia*	Chrysler*	Oldsmobile
Mazda*	GMC	Plymouth
Mercedes-Benz*	Dodge	Pontiac
Mitsubishi*	Ford*	Porsche*
Nissan*	Honda*	Mercury
Porsche*	Hummer	Saab*
Saab**	Hyundai*	Saturn
Subaru*	Infiniti	Scion
Suzuki*	Isuzu*	Subaru*
Toyota*	Jaguar	Suzuki*
Volkswagen(VW)*	Jeep	Toyota*
Volvo**	Kia*	Volkswagen (VW) *
	Land Rover	Volvo

* These brands were one level above some individual (product) brands (e.g., Chrysler Concorde; Toyota Camry) and two levels above other individual (product) brands (e.g., Chrysler's Dodge Imperial; Toyota's Scion x

** Volvo is considered as a corporate brand until its acquisition by the Ford Motor Company. Saab is considered as a corporate brand until Jan 2001 when General Motors started advertising Saab as a family brand.

Table 4

Selected Descriptive Statistics for the Dataset

	1995	**2005**
Number of Brands:		
Corporate	17	16
Family (master)	31	36
Individual	176	215
Highest Advertising USD:		
Corporate brand	63 m (Ford)	430m (GM)
Family brand	114m (Saturn)	240m (Chrysler)
Individual Brand	118m (Accord)	175m (Sonata)

Table 5

Pair-wise Correlations

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1 Individual Brand Mkt. Share	1.0																				
2 USA	.29	1.0																			
3 Japan	-.12	-.67	1.0																		
4 Europe	-.20	-.39	-.31	1.0																	
5 Generation Change	.19	-.09	.09	.01	1.0																
6 Price	-.25	-.16	-.08	.37	-.01	1.0															
7 Quality Information	-.04	-.48	.63	-.18	.05	-.03	1.0														
8 Distribution	.41	.85	-.51	-.42	-.10	-.27	-.36	1.0													
9 Promotion Qtr1	.04	.09	-.06	-.07	.05	-.06	-.07	.09	1.0												
10 Promotion Qtr2	.09	.10	-.07	-.06	.04	-.07	-.10	.10	-.15	1.0											
11 Promotion Qtr3	.05	.07	-.04	-.05	.05	-.08	-.08	.07	-.15	-.15	1.0										
12 Promotion Qtr4	.02	.09	-.06	-.04	.08	-.07	-.08	.08	-.16	-.16	-.16	1.0									
13 Car	-.15	-.13	.02	.21	.09	.11	.13	-.19	-.03	-.02	-.02	-.03	1.0								
14 Sport	-.22	-.11	.05	.11	-.11	.25	-.01	-.08	-.04	-.04	-.04	-.04	.36	1.0							
15 Luxury	-.30	-.25	-.02	.43	-.03	.58	.06	-.40	-.11	-.11	-.09	-.09	.18	.15	1.0						
16 Individual Brand Adv	.53	.09	.00	-.12	.19	-.15	.03	.10	.01	.06	-.03	.05	-.07	-.19	-.15	1.0					
17 Family Brand Adv	.25	.33	-.12	-.22	.04	-.13	-.11	.49	.05	-.01	.09	.15	-.14	.00	-.22	.08	1.0				
18 Corporate Brand Adv	.07	.46	-.30	-.17	.02	-.04	-.20	.37	.00	.11	.05	.11	-.08	-.08	-.09	-.03	.24	1.0			
19 Corp. Hierarchy Breadth	.16	.78	-.52	-.28	-.07	-.10	-.37	.67	.04	.06	.02	.05	-.09	-.13	-.15	.02	.24	.63	1. 0		
20 Family Hierarchy Breadth	.28	.32	-.08	-.27	-.11	-.15	-.10	.63	.02	.03	.01	.01	-.20	-.01	-.24	.02	.46	.23	.41	1.0	
21 Hierarchy Depth	-.03	.53	-.38	-.12	-.03	.08	-.24	.28	.00	.01	-.01	.01	.01	-.11	.13	-.01	.01	.41	.66	.00	1.0

Table 6

Variable Definitions and Summary Statistics

Construct	Variable Name	Description	Mean	Std.Dev.
Manufacturer / Country-of-Origin	GM_{jt}	Origin of heritage for individual brand *j* in period *t*	.25	.44
	$Ford_{jt}$		.14	.35
	$Chrysler_{jt}$		.10	.30
	$Japan_{jt}$		.34	.47
	$Europe_{jt}$		.15	.36
Generation Change	$Inno_{jt}$	Trend variable to code for new generation model introduced for individual brand *j* in period *t*	1.44	.64
Price	$Price_{jt}$	Median list price of individual brand *j* in period *t*	23,598.7	16,251.7
Quality Information	$Quality_{jt}$	Reliability scores from Consumer Reports for individual brand *j* in period *t* (annual)	3.04	1.21
Distribution	$Distrib_{jt}$	Number of distributors of individual brand j in period *t*	1,732.9	1,415.9
Promotion Qtr1	$PromoQ1_{jt}$	Indicator of a manufacturer promotion incentive (rebate or financing) for individual brand *j* in period *t*	.13	.34
Promotion Qtr2	$PromoQ2_{jt}$		.13	.33
Promotion Qtr3	$PromoQ3_{jt}$		.13	.34
Promotion Qtr4	$PromoQ4_{jt}$		.15	.35
Product Attributes	$Size_{jt}$	Size, hp and miles per $ of individual brand *j* in period *t*	1.35	.18
	HP_{jt}		189.4	59.34

	$Miles/Dollar_{jt}$		.19	.06
Individual Brand Adv	$IndivAdv_{jt}$	Total national advertising expenditures for individual brand *j* in period *t*	6,086.4	8882.2
Family Brand Adv	$FamilyAdv_{jt}$	Total national advertising expenditures for the brand one level above individual brand *j* in period *t*	12,978.5	14,877.3
Corporate Brand Adv	$CorpAdv_{jt}$	Total national advertising expenditures for the brand two levels above individual brand *j* in period *t*	15,713.7	25,544.0
Corp. BreadthOfHierarchy	$CorpBreadth_{jt}$	Breadth and depth of the branding strategy of the corporate brand	8.85	5.37
Family BreadthOfHierarchy	$FamilyBreadth_{jt}$	Breadth and depth of the branding strategy of the family brand in period *t*	3.84	1.32
DepthOfHierarchy	$HierDepth_{jt}$	Number of distinct corporate and family brands above the individual brand period *t*	1.50	.50

Table 7

Results from Random Coefficient Logit

			Heterogeneity	
Variable	**Estimate**	**S.E.**	**S.D.**	**S.E.**
$Intercept_{jt}$	11.31	2.67	.04	5.31
GM_{jt}	.96	.22		
$Ford_{jt}$	1.10	.11		
$Chrysler_{jt}$	.89	.12		
$Japan_{jt}$	.17	.07		
$Europe_{jt}$	.89	.10		
$Inno_{jt}$	.08	.05		
$Ln(Price)_{jt}$	-2.39	.33		
$Quality_{jt}$	.11	.03		
$PromoQ1_{jt}$	.08	.16		
$PromoQ2_{jt}$	.38	.10		
$PromoQ3_{jt}$	.23	.07		
$PromoQ4_{jt}$	.02	.20		
$Size_{jt}$	1.52	.33	.05	.00
HP_{jt}	.00	.00	.00	.00
$Miles/Dollar_{jt}$	-2.66	1.64	.13	.03
Car_{jt}	.28	.12		
$Sport_{jt}$	-.59	.06		
$Luxury_{jt}$	.11	.07		
$Ln(Indiv.\ Adv)_{jt}$	.12	.00		
$Ln(Family\ Adv)_{jt}$	.07	.04		
$Ln(Corp.\ Adv)_{jt}$	.04	.02		
$CorpBreadth_{jt}$	.19	.05		
$FamilyBreadth_{jt}$	.09	.22		
$HierDepth_{jt}$	-.10	.31		
$Ln(Corp.\ Adv)_{jt}$ x $Corp.\ Brand\ Breadth_{jt}$	-.01	.00		
$Ln(Family\ Adv)_{jt}$ x $Family\ Brand\ Breadth_{jt}$	.00	.01		
$Ln(Corp.\ Adv)_{jt}$ x $Depth_{jt}$	.02	.02		
$Ln(Family\ Adv)_{jt}$ x $Depth_{jt}$	-.03	.02		

Table 8

Cross price Elasticity Matrix

	Nissan	Chrysler	Toyota	Hyundai	Chevrolet	Mercury	Saturn	Kia
Nissan	-0.17817	0.00836	0.00663	0.00464	0.00952	0.00772	0.00546	0.00369
Chrysler	0.00605	-0.25683	0.00693	0.00499	0.00912	0.00703	0.00587	0.00414
Toyota	0.00584	0.00875	-0.11290	0.00467	0.00960	0.00754	0.00599	0.00398
Hyundai	0.00771	0.00943	0.00776	-0.39312	0.00738	0.00664	0.00476	0.00529
Chevrolet	0.00590	0.00873	0.00674	0.00483	-0.08589	0.00789	0.00591	0.00430
Mercury	0.00559	0.00818	0.00676	0.00417	0.01048	-0.33323	0.00664	0.00309
Saturn	0.00555	0.00817	0.00603	0.00415	0.00849	0.00658	-0.39423	0.00360
Kia	0.00690	0.00821	0.00691	0.00601	0.00587	0.00416	0.00338	-0.39328

- Bootstrap intervals available on request
- Figures indicate % change in column family brand's market share for a 1% change in row family brand's price

Table 9

Family Brand Advertising and Breadth Elasticities

Family Brand	Family Brand Adv.	Family Brand Breadth
Acura	0.0205	0.4223
Audi	0.0192	0.3739
BMW	0.0499	0.4791
Buick	0.0213	0.4638
Cadillac	0.0227	0.5200
Chevrolet	0.0365	1.0638
Chrysler	0.0523	0.5982
Dodge	0.0248	0.6160
Ford	0.0576	0.7948
GMC	0.0246	0.5732
Honda	0.0505	0.5058
Hummer	0.0168	0.1685
Hyundai	0.0480	0.4058
Infiniti	0.0198	0.4018
Isuzu	0.0519	0.5298
Jaguar	0.0175	0.3200
Jeep	0.0189	0.3817
Kia	0.0476	0.3925
Land Rover	0.0195	0.3652
Lexus	0.0253	0.6237
Lincoln	0.0200	0.4180
Mazda	0.0512	0.5245
Mercedes	0.0521	0.5621
Mercury	0.0200	0.3975
Mini	0.0127	0.0606
Mitsubishi	0.0509	0.5186
Nissan	0.0532	0.6163
Oldsmobile	0.0256	0.6074
Plymouth	0.0174	0.2884
Pontiac	0.0218	0.4822
Porsche	0.0485	0.3911
Saab	0.0320	0.2510
Saturn	0.0173	0.3277
Scion	0.0175	0.2672
Subaru	0.0468	0.3595
Suzuki	0.0524	0.5208
Toyota	0.0559	0.7227
VW	0.0489	0.4477
Volvo	0.0289	0.4460

- Bootstrap intervals available on request

Table 10

Corporate Brand Advertising and Breadth Elasticities

Corporate Brand	Corp. Brand Adv.	Corp. Brand Breadth
BMW	0.0070	0.1513
Chrysler	-0.0275	-0.0732
Ford	-0.0435	-0.2214
General Motors	-0.1351	-0.6144
Honda	0.0090	-0.0652
Hyundai	0.0258	0.1060
Isuzu	0.0135	0.3153
Jaguar	-0.0345	-0.2197
Kia	0.0270	0.1673
Land Rover	-0.0056	0.0202
Mazda	0.0153	0.3824
Mercedes	0.0122	0.0532
Mini	0.0305	0.0912
Mitsubishi	0.0180	0.3693
Nissan	0.0014	0.0391
Porsche	0.0244	0.4364
Subaru	0.0280	0.2893
Suzuki	0.0115	0.3145
Toyota	-0.0198	-0.1425
VW	0.0200	0.2541

- Bootstrap intervals available on request

Table 11

Results of Policy Simulations

Assumptions:

- Pontiac brands are sold under Chevrolet in both scenarios.
- Scenario 1: GM deletes Saab, Saturn and Hummer from its portfolio. These brands do not compete in the US market.
- Scenario 2: In addition to Scenario 1, 50% of GM's corporate brand advertising effort is reallocated to its four family brands equally.

Family Brand	Actual Share '05	Scenario 1: Brand Pruning	Scenario 2: Adv. Reallocation
Chevrolet	13.8%	17.1%	18.2%
GMC	3.5%	2.4%	2.6%
Buick	1.1%	1.4%	1.5%
Cadillac	1.2%	1.4%	1.5%
Pontiac	1.8%		
Saab	0.2%		
Saturn	1.4%		
Hummer	0.0%		
GM Total	**22.9%**	**22.3%**	**23.8%**

Table 12

Brand Breadth, Extension Similarity and Attitude Rating

Context	Breadth Measure	Typicality Rating	Attitude Rating
Narrow brand with similar extension	Narrow	Typical	Positive
Narrow brand with dissimilar extension	Moderate	Atypical	Negative
Broad brand with similar extension	High	Typical	Positive

Table 13

Characteristics of Categories for Final Analysis

Category	No. of Alternatives	% HH repeat purchase	Purchase Frequency	Final Analysis
Household Cleaner	1851	83%	59 days	Yes
Liquid Laundry Detergent	1510	35%	88 days	Yes
Yogurt	4082	65%	44 days	Yes
Toothpaste	2373	70%	79 days	Yes
Soups	5690	92%	47 days	No
Deodorant	3252	59%	81 days	No
Shampoo	7877	60%	77 days	No
Mayo	745	69%	82 days	No
Mustard/Ketchup	2097	67%	75 days	No
Italian Sauce	2625	62%	68 days	No

Table 14

Categories Dropped from Consideration for Final Analysis

Category	Rationale for Drop
Beer	Brands not extended
Beverages	Brands not extended
Cereal	Private label skus constitute 30% of available choice
Cigarettes	Brands not extended
Coffee	Brands not extended
Diapers	Brands not extended
Frozen Pizza	Brands not extended
Frozen Dinners	Brands extended outside CPG (e.g., Weight Watchers)
Hot Dog	Brand information not available for all years in annual IRI
Margarine/Butter	Brands not extended
Milk	Too many sub-categories (whole, fat, skim, flavored, buttermilk)
Peanut Butter	Brands not extended; few alternatives
Paper Towels	Brands not extended
Razors	Only two dominant brands
Razor Blades	Only two dominant brands
Sugar	Brands not extended
Facial Tissue	Brands not extended
Bathroom Tissue	Brands not extended
Photo films	Brands extended outside CPG (e.g., cameras)
Salty Snacks	Brands not extended

Table 15

Example of Advertising Data Classification

Observed Brand	Category	Classification
Clorox Clean Up	HH Cleaner	Focal brand advertising
Clorox Anywhere	HH Cleaner	Advertising brand extension in the same category
Clorox Fresh Care	Laundry Detergent	Advertising brand extension in a different category

Table 16

Characteristics of Market Leaders in Household Cleaner Category

Year	Brand	Brand Variant Description	Incongruity	Breadth	Mkt. Share
	CLOROX CLEAN UP ALL PURPOSE SPRAY	+CCLNP ALPRP CLNR SPRY 32OZ	1.719	5.657	4.54%
2001	PINE SOL DISINFECT. DEODORIZR LIQUID	+PNSOL PINE DISFD CLNR LIQ 48OZ	1.066	1.414	4.15%
	FORMULA 409 ALL PURPOSE ANTBCTRL SPRAY	+FR409 APABT CLNR SPRY 32OZ	1.238	3.162	3.92%
	CLOROX CLEAN UP ALL PURPOSE SPRAY	+CCLNP ALPRP CLNR SPRY 32OZ	1.744	5.745	4.47%
2002	PINE SOL DISINFECT. DEODORIZR LIQUID	+PNSOL PINE DISFD CLNR LIQ 48OZ	1.083	1.414	3.63%
	MR CLEAN ALL PURPOSE LIQUID	+MRCLN SMCTR ALPRP CLNR LIQ 40OZ	1.240	1.414	3.62%
	CLOROX CLEAN UP ALL PURPOSE SPRAY	+CCLNP ALPRP CLNR SPRY 32OZ	1.741	7.550	4.88%
2003	PINE SOL DISINFECT. DEODORIZR LIQUID	+PNSOL PINE DISFD CLNR LIQ 48OZ	1.107	1.000	3.87%
	MR CLEAN ALL PURPOSE LIQUID	+MRCLN SMCTR ALPRP CLNR LIQ 40OZ	1.246	2.236	3.79%
	CLOROX CLEAN UP ALL PURPOSE SPRAY	+CCLNP ALPRP CLNR SPRY 32OZ	1.763	8.124	5.51%
2004	PINE SOL DISINFECT. DEODORIZR LIQUID	+PNSOL PINE DISFD CLNR LIQ 48OZ	1.114	1.414	4.75%
	CLOROX CLEAN UP ALL PURPOSE LIQUID	+CCLNP ALPRP CLNR LIQ 64OZ	1.549	8.124	4.00%
	CLOROX CLEAN UP ALL PURPOSE SPRAY	+CCLNP ALPRP CLNR SPRY 32OZ	1.739	7.550	6.02%
2005	PINE SOL DISINFECT. DEODORIZR LIQUID	+PNSOL PINE DISFD CLNR LIQ 48OZ	1.137	1.000	5.06%
	CLOROX CLEAN UP ALL PURPOSE LIQUID	+CCLNP ALPRP CLNR LIQ 64OZ	1.544	7.550	4.31%

Table 17

Summary Statistics*

Category	Year	Price	Feature	Display	Own Adv ($000)	Same Category Adv ($000)	Diff. Category Adv ($ 000)	Incongruity	Breadth
Household Cleaner	2001	1.48 (1.05)	0.02 (0.07)	0.1 (0.28)	1.96 (24.29)	39.03 (192.96)	8.15 (69.83)	1.43 (0.34)	3.25 (3.14)
	2002	1.43 (1.19)	0.02 (0.08)	0.12 (0.3)	0.11 (2.59)	12.69 (84.87)	5.42 (62.09)	1.47 (0.34)	2.9 (2.58)
	2003	1.41 (1.28)	0.02 (0.08)	0.12 (0.28)	0.34 (14.17)	18.41 (100.12)	5.02 (58.71)	1.48 (0.33)	2.93 (2.55)
	2004	1.4 (1.17)	0.03 (0.09)	0.11 (0.25)	0.22 (8.42)	13.1 (86.15)	11.88 (130.04)	1.49 (0.32)	2.84 (2.58)
	2005	1.36 (1.07)	0.02 (0.09)	0.11 (0.26)	0.02 (1.04)	26.22 (114.69)	14.82 (177.11)	1.5 (0.33)	2.8 (2.38)
Liquid Laundry Detergents	2001	0.76 (0.26)	0.06 (0.14)	0.11 (0.22)	0.03 (1.11)	0.17 (4.63)	0.31 (4.87)	1.32 (0.34)	2.84 (2.95)
	2002	0.74 (0.26)	0.07 (0.15)	0.09 (0.17)	0.09 (2.33)	0.14 (3.18)	0.07 (1.71)	1.33 (0.3)	3.42 (3.68)
	2003	0.75 (0.31)	0.07 (0.13)	0.1 (0.18)	0.05 (1.16)	0.54 (12.85)	0.07 (1.58)	1.34 (0.28)	3.56 (3.56)
	2004	0.8 (0.3)	0.08 (0.15)	0.1 (0.18)	0.06 (1.51)	0.18 (2.31)	0.2 (3.24)	1.31 (0.23)	4.11 (3.49)
	2005	0.81 (0.47)	0.08 (0.15)	0.1 (0.19)	0.03 (0.85)	0.27 (4.41)	0.38 (7.55)	1.34 (0.21)	4.15 (3.12)
Yogurt	2001	1.42 (0.36)	0.08 (0.17)	0.02 (0.07)	0.03 (1)	0.2 (3.26)	0.38 (6.48)	1.67 (0.19)	5.21 (4.17)
	2002	1.47 (0.39)	0.09 (0.18)	0.02 (0.05)	0.01 (0.65)	0.07 (1.66)	0.04 (1.56)	1.67 (0.2)	5.34 (4.83)
	2003	1.47 (0.43)	0.08 (0.17)	0.02 (0.06)	0.01 (0.89)	0.14 (2.11)	0.05 (2.12)	1.67 (0.2)	5.57 (4.85)
	2004	1.51 (0.46)	0.08 (0.16)	0.02 (0.06)	0.00 (0.13)	0.04 (0.76)	0.05 (1.39)	1.69 (0.21)	6.28 (6.81)
	2005	1.51 (0.49)	0.08 (0.16)	0.02 (0.07)	0.01 (0.45)	0.82 (9.34)	0.46 (10.48)	1.7 (0.21)	6.47 (7.1)
Toothpaste	2001	9.24 (6.64)	0.05 (0.11)	0.09 (0.21)	0.1 (2.42)	1.98 (17.99)	2.39 (27.98)	2.03 (0.24)	9.95 (4.83)
	2002	8.97 (6.68)	0.05 (0.12)	0.11 (0.24)	0.02 (0.82)	0.32 (3.78)	0.45 (7.31)	2.03 (0.24)	12.28 (5.45)
	2003	8.51 (6.18)	0.06 (0.13)	0.11 (0.22)	0.02 (1.07)	0.7 (9.35)	0.62 (7.51)	2.04 (0.22)	14.7 (5.2)
	2004	8.61 (6.52)	0.06 (0.13)	0.11 (0.24)	0.01 (0.9)	0.86 (10.32)	0.71 (8.38)	2.04 (0.22)	17.08 (7.03)
	2005	8.81 (7.05)	0.07 (0.15)	0.11 (0.23)	0.42 (9.32)	3.56 (43.03)	3.52 (42.69)	2.02 (0.23)	19.8 (9.11)

*** Table reports means with standard deviation in parentheses**

Table 18

Results from Random Coefficient Logit

Variable	Expected Sign	HH Cleaner		Liquid Laundry		Yogurt		Toothpaste	
		Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept		2.11	**1.88**	-4.66	**-3.73**	-6.49	**-5.61**	-16.57	-
Price ($)	-	-0.95	**-5.44**	-3.71	**-12.26**	-1.23	**-13.04**	-0.35	-
Feature	+	-0.30	-0.33	1.22	**7.48**	1.21	**15.70**	1.15	**13.70**
Display	+	2.11	**3.18**	1.94	**12.01**	3.43	**15.86**	2.92	**12.98**
Own Adv ($ 000)	+	0.00	**3.15**	0.00	0.18	0.00	1.16	0.00	0.08
Adv Same Cat ($ 000)	?	0.00	1.41	0.00	1.25	0.00	**1.69**	0.00	**-2.07**
Adv Diff Cat ($ 000)	+	-0.00	**-10.07**	-0.00	-1.19	0.00	0.12	0.00	0.56
Congruity 2001	CB/Econ	-15.34	**-12.77**	2.79	**2.31**	-0.42	-0.28	-2.19	**-1.66**
Congruity^2 2001	CB/Econ	4.68	**11.89**	-3.01	**-6.41**	-0.07	-0.16	0.13	0.39
Congruity 2002	CB/Econ	-15.60	**-12.13**	1.54	1.13	3.11	**2.21**	1.26	0.98
Congruity^2 2002	CB/Econ	4.84	**11.54**	-2.55	**-4.86**	-0.98	**-2.33**	-0.86	**-2.73**
Congruity 2003	CB/Econ	-16.55	**-12.17**	2.39	**1.76**	7.51	**5.64**	6.07	**4.45**
Congruity^2 2003	CB/Econ	5.15	**11.69**	-2.78	**-5.35**	-2.18	**-5.44**	-1.99	**-5.96**
Congruity 2004	CB/Econ	-18.29	**-13.18**	-0.56	-0.37	0.92	0.69	-2.20	-1.50
Congruity^2 2004	CB/Econ	5.65	**12.59**	-1.77	**-3.10**	-0.18	-0.44	-0.17	-0.47
Congruity 2005	CB/Econ	-17.89	**-12.39**	-3.29	**-1.79**	-1.54	-1.11	5.26	**3.63**
Congruity^2 2005	CB/Econ	5.39	**11.59**	-1.09	-1.59	0.58	1.38	-2.01	**-5.62**
Breadth 2001	-	0.01	0.49	0.83	**10.24**	-0.21	**-16.14**	0.17	**10.79**
Breadth^2 2001	+	0.01	**3.15**	-0.07	**-6.97**	0.01	**12.73**	-0.01	-
Breadth 2002	-	0.03	1.51	0.78	**13.08**	-0.15	**-16.19**	0.23	**18.07**
Breadth^2 2002	+	0.00	**2.83**	-0.06	**-8.77**	0.01	**11.66**	-0.01	-
Breadth 2003	-	-0.24	**-11.38**	0.59	**10.02**	-0.26	**-25.88**	0.15	**14.63**
Breadth^2 2003	+	0.05	**8.72**	-0.04	**-6.32**	0.01	**20.27**	-0.00	**-8.79**
Breadth 2004	-	-0.24	**-10.13**	0.65	**10.36**	-0.28	**-34.62**	0.24	**23.75**
Breadth^2 2004	+	0.02	**7.38**	-0.05	**-6.71**	0.01	**31.21**	-0.00	-
Breadth 2005	-	-0.18	**-7.50**	0.55	**7.72**	-0.23	**-32.06**	0.41	**34.93**

Variable	Expected Sign	HH Cleaner		Liquid Laundry		Yogurt		Toothpaste	
		Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Breadth^2 2005	+	0.01	**2.71**	-0.05	**-5.14**	0.01	**23.28**	-0.011	-
Year 2001		-1.51	**-4.21**	-3.50	**-5.33**	-2.73	**-4.49**	10.46	**11.84**
Year 2002		-1.94	**-6.28**	-3.01	**-5.09**	-6.36	**-11.99**	6.50	**8.16**
Year 2003		-1.01	**-3.69**	-3.82	**-6.58**	-9.99	**-20.96**	0.88	1.13
Year 2004		0.19	0.74	-2.14	**-3.84**	-4.67	**-12.67**	8.97	**12.43**
Heterogeneity									
Intercept		5.12	**3.80**	5.38	**3.37**	5.47	**4.50**	4.97	**4.53**
Price ($)		3.76	**3.46**	4.95	**3.24**	2.93	**4.42**	0.53	**4.47**
Feature		3.19	**2.84**	2.40	**2.93**	2.17	**3.89**	2.18	**3.74**
Display		2.79	**2.87**	2.34	**2.96**	5.37	**3.19**	6.43	**3.74**

Figure 1

Example of a Brand Hierarchy: General Motors

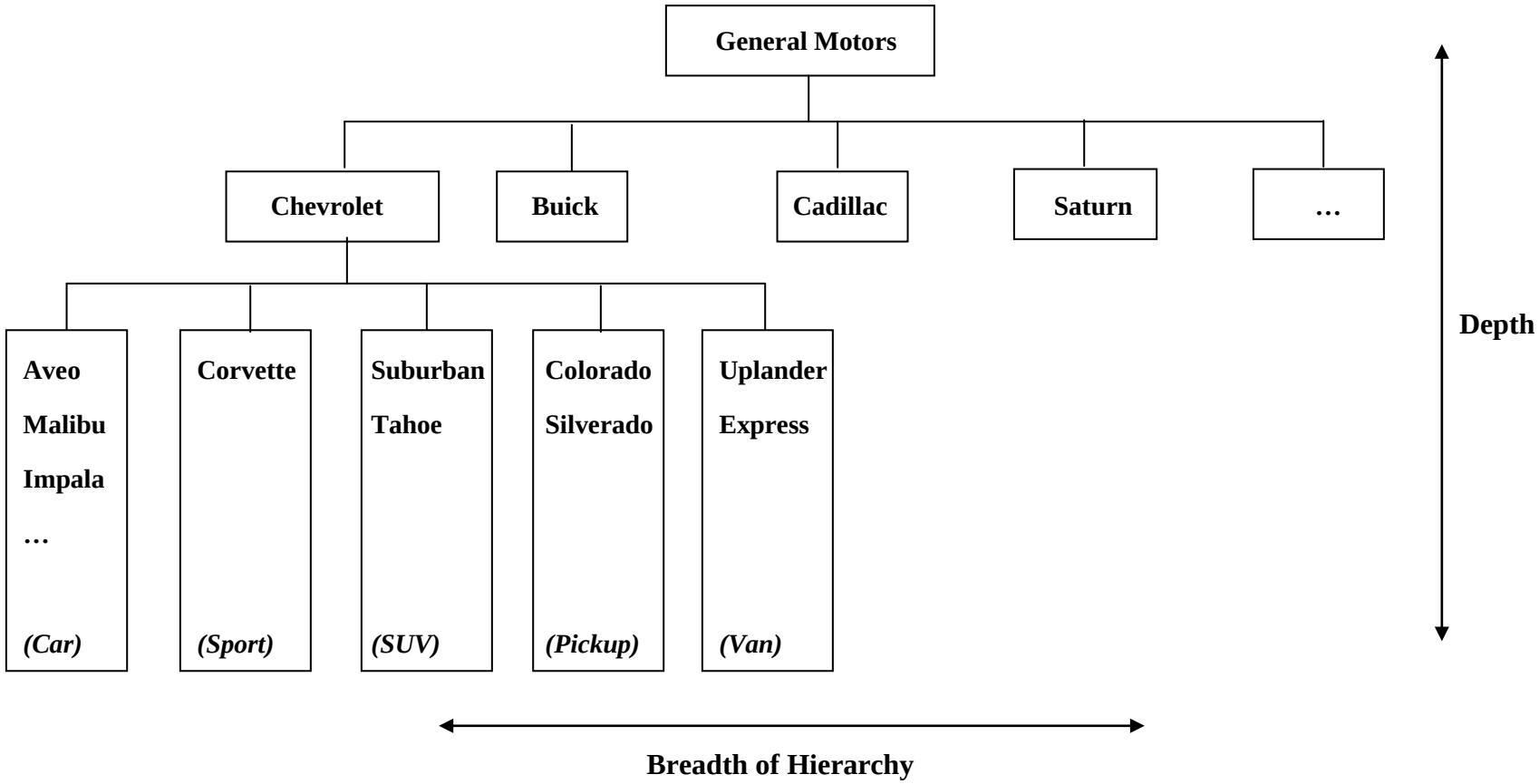

Figure 2

Trends in Corporate Brand Advertising Effort (Quarters)

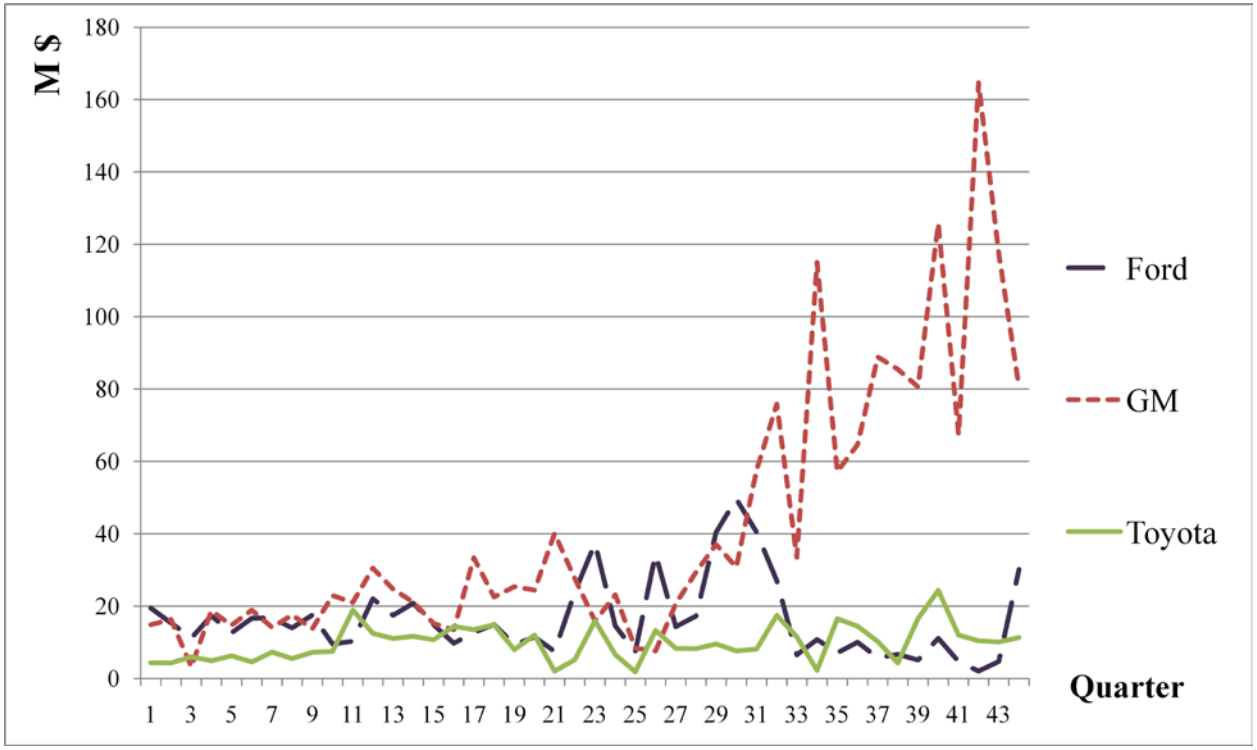

Figure 3

Within-Category Incongruity and Across-Category Extensions: Crest Toothpaste

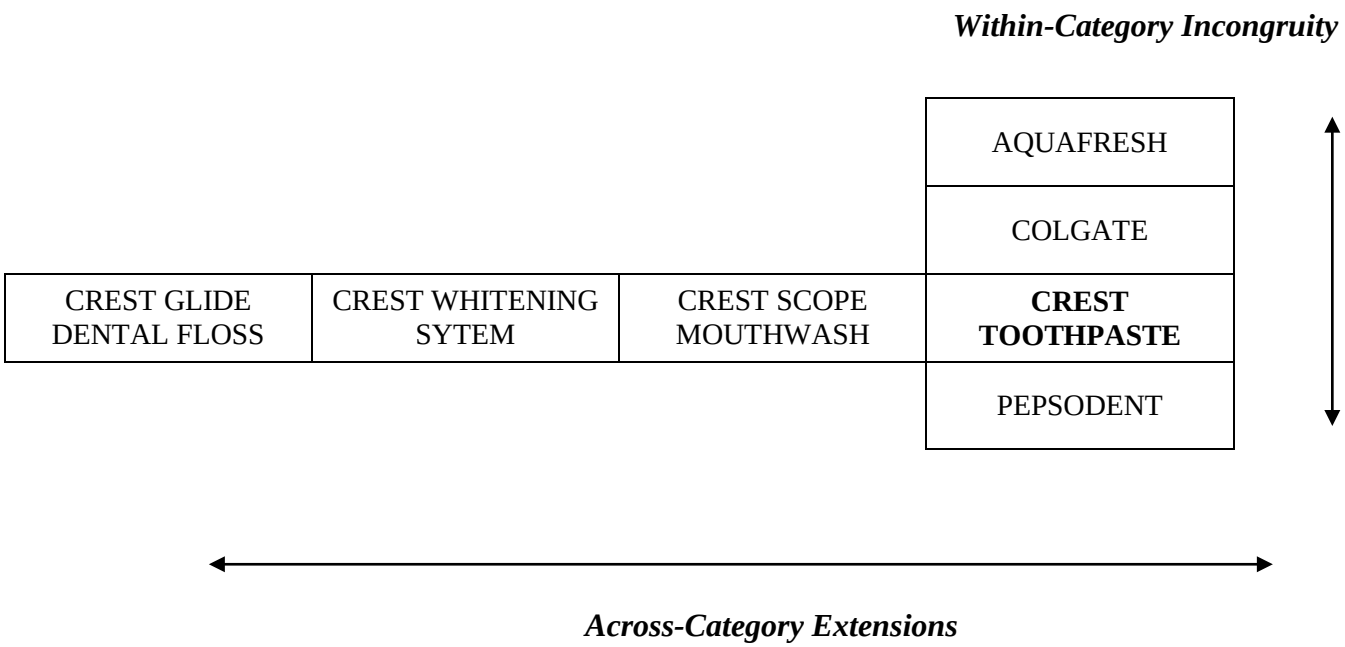

Figure 4

Incongruity-Typicality Matrix

Within Category

Brand Extension Typicality	Moderate Incongruity	Low or High Incongruity
Moderate Breadth	**Q1 – *Middle Path*** Toothpaste	**Q2 – *Differentiation with Moderation*** Liquid Laundry
Low or High Breadth	**Q4 – *Moderation with extremism*** Yogurt	**Q3 – *All or little*** HH Cleaner

4 Conclusion

While brand architectures are often discussed they are seldom researched. The aim of the dissertation is to conduct a rigorous analysis of brand architectures that firms typically employ and their impact on individual brand performance. Two studies were conducted to carry out a comprehensive analysis of the different brand architectures that firms employ in different industries and develop a deeper understanding of their impact on performance.

In the first essay, brand architecture was studied using the brand hierarchy framework. A theoretical framework to understand how breadth and depth of breadth and depth of brand hierarchy affect both individual brand performance and effectiveness of advertising at higher levels of the hierarchy was developed. Using a structural model, analysis was conducted using data from the US Auto industry. The results from the estimation and policy simulations now help us understand better how brands at different levels of the hierarchy work. Firms can use these results to make suitable changes to their brand architecture and decide where to allocate their advertising resources to improve performance.

In the second essay, the study considers the effects of within-category differentiation and spillovers from extensions across categories on individual brand performance. Contrasting theories from the behavioral literature and from economics were tested using data from four different categories in the consumer packaged goods industry. Using the Incongruity-Typicality matrix, firms now have a better understanding of the non-linear effects of within-category incongruity and across-category typicality for different product categories. The study also lays down a framework to understand consumer preferences changing over time.

5 References

Aaker, David A. and Erich Joachimsthaler (2000), Brand Leadership. New York, NY: Free Press.

Aaker, David A. (2004), Brand Portfolio Strategy: Free Press New York.

Aaker, David A. and Kevin L. Keller (1990), "Consumer Evaluations of Brand Extensions," Journal of Marketing, 54 (1), 27-41.

Ahlin, Christian and Peter Ahlin (2006), "Hotelling Was Right about Congestible Goods," Vanderbilt University Typescript.

Anderson, Simon P. and Damien J. Neven (1991), "Cournot Competition Yields Spatial Agglomeration," International Economic Review, 32 (4), 793-808.

Ataman, Berk A., Herald J. Van Heerde and Carl F. Mela, “The Long-Term Effect of Marketing Strategy on Brand Sales,” Journal of Marketing Research, forthcoming.

Berens, Guido, Cees B. M. Riel, and Gerrit. H. Bruggen (2005), "Corporate associations and consumer product responses: the moderating role of corporate brand dominance," Journal of Marketing, 69 (3), 35-48.

Berry, Steve, James Levinsohn, and Ariel Pakes (1995), "Automobile Prices in Market Equilibrium," Econometrica: Journal of the Econometric Society, 63 (4), 841-90.

Besanko, David, Sachin Gupta, and Dipak Jain (1998), "Logit Demand Estimation under Competitive Pricing Behavior: An Equilibrium Framework," Management Science, 44 (1, Part 1 of 2), 1533-47.

Bettman, James R. (1979), "Memory Factors in Consumer Choice: A review," Journal of Marketing, 43 (2), 37-53.

Bordley, Robert (2003), "Determining the Appropriate Depth And Breadth of a Firm’s Product Portfolio," Journal of Marketing Research, 40 (1), 39-53.

Bottomley, Paul A. and John R. Doyle (1996), "The Formation of Attitudes towards Brand Extensions: Testing and Generalising Aaker and Keller's Model," International Journal of Research in Marketing, 13 (4), 365-77.

Bottomley, Paul A. and Stephen J. S. Holden (2001), "Do I Really Know How Consumers

Evaluate Brand Extensions? Empirical Generalizations Based on Secondary Analysis of Eight Studies," Journal of Marketing Research, 38 (4), 494-500.

Boush, David M. and Barbara Loken (1991), "A Process-Tracing Study of Brand Extension Evaluation," Journal of Marketing Research, 28 (1), 16-28.

Bowman, Douglas and Hubert Gatignon (1996), "Order of Entry as a Moderator of the Effect of the Marketing Mix on Market Share," Marketing Science, 32 (1), 222-42.

Bresnahan Timothy F., Scott Stern, and Manuel Trajtenberg (1997), “Market Segmentation and the Sources of Rents from Innovation: Personal Computers in the 1980s”, RAND Journal of Economics, 28(0) S17–44.

Broniarczyk, Susan M. and Joseph W. Alba (1994), "The Importance of the Brand in Brand Extension," Journal of Marketing Research, 31 (2), 214-28.

Bronnenberg, Bart J., Michael W. Kruger, and Carl F. Mela (2008), "The IRI Marketing Data Set," Marketing Science, 27 (4), 745-48.

Brown, Tom J. and Peter A. Dacin (1997), "The Company and the Product: Corporate Associations and Consumer Product Responses," Journal of Marketing, 61 (1), 68-84.

Chernev, Alexander (2007), "The effect of Common Features on Brand Choice: Moderating Role of Attribute Importance," Journal of Consumer Research, 23 (4), 304-11.

---- (2004), "Extremeness Aversion and Attribute-Balance Effects in Choice," Journal of Consumer Research, 31 (2), 249-63.

Chintagunta, Pradeep (2002), “Investigating Category Pricing in a Retail Chain,” Journal of Marketing Research, 39(2), 141-154.

Dacin, Peter A. and Daniel C. Smith (1994), "The Effect of Brand Portfolio Characteristics on Consumer Evaluations of Brand Extensions," Journal of Marketing Research, 20 (1), 229-42.

Dasgupta, Partha and Eric Maskin (1986), "The Existence of Equilibrium in Discontinuous Economic Games, I: Theory," The Review of Economic Studies, 53 (1), 1-26.

---- (1986), "The Existence of Equilibrium in Discontinuous Economic Games, II: Applications," The Review of Economic Studies, 53 (1), 27-41.

d'Aspremont, Claude, Jean J. Gabszewicz, and Jacques F. Thisse (1979), "On Hotelling's "Stability in Competition"," Econometrica, 47 (5), 1145-50.

Dhar, Ravi and Itamar Simonson (2003), "The Effect of Forced Choice on Choice," Journal of Marketing Research, 40 (2), 146-60.

---- (1992), "The Effect of the Focus of Comparison on Consumer Preferences," Journal of Marketing Research, 29 (4), 430-40.

Dube, Jean-Pierre., Pradeep Chintagunta, Amil Petrin, Bart Bronnenberg, Ron Goettler, P. B. Seetharaman, K. Sudhir, Raphael Thomadsen, and Ying Zhao (2002), "Structural Applications of the Discrete Choice Model," Marketing Letters, 13 (3), 207-20.

Echambadi, Raj, Inigo Arroniz, Werner Reinartz, and Junsoo Lee (2006), "Empirical Generalizations from Brand Extension Research: How Sure Are I?," International Journal of Research in Marketing, 23 (3), 253-61.

Erdem, Tulin (1998), "An Empirical Analysis of Umbrella Branding," Journal of Marketing Research, 35 (3), 339-51.

Erdem, Tulin and Baohong Sun (2002), "An Empirical Investigation of the Spillover Effects of Advertising and Sales Promotions in Umbrella Branding," Journal of Marketing Research, 39 (4), 408-20.

Erdem, Tulin and Russ S. Winer (1999), "Econometric Modeling of Competition: A Multi-

Category Choice-Based Mapping Approach," Journal of Econometrics, 89 (1-2), 159-75.

Fader, Peter S. and Bruce G. S. Hardie (1996), "Modeling Consumer Choice among SKUs," Journal of Marketing Research, 33 (4), 442-52.

Farquhar, Peter. H., Julia Y. Han, Paul M. Herr, and Yuji Ijiri (1992), "Strategies for Leveraging Master Brands," Marketing Research, 4 (3), 32-43.

Fry, Joseph N. (1967), "Family Branding and Consumer Brand Choice," Journal of Marketing Research, 4 (3), 237-47.

Garbarino, Ellen C. and Julie A. Edell (1997), "Cognitive Effort, Affect, and Choice," Journal of Consumer Research, 24 (2), 147-58.

Granovetter, Mark (1973), "The Strength of Weak Ties," American Journal of Sociology, 78 (6), 1360-1380.

Harlam, Bari A. and Leonard M. Lodish (1995), “Modeling Consumers’ Choices of Multiple Items”, Journal of Marketing Research, 32(4), 404-418.

Hanssens, Dominque M., Leonard J. Parsons and Randall L. Schultz. *Market Response Models: Econometric and Time Series Research*, Kluwer Academic Publishers, 1990.

Heilman, Carrie M. and Douglas Bowman and Gordon P. Wright (2000), "The Evolution of Brand Preferences and Choice Behaviors of Consumers New to a Market," Journal of Marketing Research, 37(2), 139-155.

Hoffer, George E. and Rober J. Reilly (1984), "Automobile Styling as a Shift Variable: An Investigation by Firm and by Industry," Applied Economics, 16 (2), 291-98.

Hotelling, Harold (1929), "Stability in Competition," The Economic Journal, 39 (153), 41-57.

Huber, Joel, John W. Payne, and Christopher Puto (1982), "Adding Asymmetrically Dominated Alternatives: Violations of Regularity and the Similarity Hypothesis," Journal of Consumer Research, 9 (1), 90-98.

Jedidi, Kamel, Carl F. Mela and Sunil Gupta (1999), "Managing Advertising and Promotion for Long-Run Profitability," Marketing Science, 18(1), 1-22.

Kahneman, Daniel (1973), *Attention and effort*, Englewood Cliffs, NJ: Prentice-Hall, Inc.

Keller, Kevin L. (2008), *Strategic Brand Management: Building, Measuring and Managing Brand Equity*, 3rd Edition, Upper Saddle River, NJ: Prentice Hall, Inc.

Keller, Kevin L. and Richard Staelin (1989), “Assessing Biases in Measuring Decision Effectiveness and Information Overload,” Journal of Consumer Research, 15(4), 504-508.

Keller, Kevin L. and Richard Staelin (1987), “Effects of Quality and Quantity of Information on Decision Effectiveness,” Journal of Consumer Research, 14(2), 200-213.

Kirmani, Amna, Sanjay Sood, and Sheri Bridges (1999), "The Ownership Effect in Consumer Responses to Brand Line Stretches," Journal of Marketing, 63 (January), 88-101.

Klink, Richard R. and Daniel C. Smith (2001), "Threats to the External Validity of Brand Extension Research," Journal of Marketing Research, 38 (3), 326-35.

Lane, Vicki and Robert Jacobson (1995), "Stock Market Reactions to Brand Extension Announcements," Journal of Marketing, 59 (1), 63-77.

Mandler, George (1982), "The Structure of Value: Accounting for Taste," In M.S. Clark and S.T. Fiske (Eds.) Affect and cognition: The Seventeenth Annual Carnegie Symposium on Cognition, Hillsdale, N.J.: Lawrence Erlbaum Associates.

Markman, Arthur B. (2001), “Structural Alignment, Similarity, and the Internal Structure of

Category Representations", in *Similarity and categorization*, Ulrike Hahn & Michael Ramscar, eds. Oxford, England: Oxford University Press, 109–130.

Markman, Arthur and Dedre Gentner (1993a), "Splitting the Differences: A Structural Alignment View of Similarity", Journal of Memory and Language, 40, 23-262.

Markman, Arthur and Douglas L. Medin (1995), "Similarity and Alignment in Choice", Organizational Behavior and Human Decision Processes, 63(2), 117-130.

Meyers-Levy, Joan and Alice M. Tybout (1989), "Schema Congruity as a Basis for Product Evaluation," Journal of Consumer Research, 16 (1), 39-54.

Montgomery, Cynthia A. and Birger Wernerfelt (1992), "Risk Reduction and Umbrella Branding," Journal of Business, 65 (1), 31-50.

Morgan, Neil A. and Lopo L. Rego (2009), "Brand Portfolio Strategy and Firm Performance," Journal of Marketing, 73 (1), 59-74.

Neuhaus, Colin F. and James R. Taylor (1972), "Variables Affecting Sales of Family-Branded Products," Journal of Marketing Research, 9 (4), 419-22.

Nevo, Aviv (2001), "Measuring Market Power in the Ready-To-Eat Cereal Industry," Econometrica, 69 (2), 307-42.

Osborne, Martin J. and Carolyn Pitchik (1987), "Equilibrium in Hotelling's Model of Spatial Competition," Econometrica: Journal of the Econometric Society, 55 (4), 911-22.

Pal, Debashish (1998), "Does Cournot Competition Yield Spatial Agglomeration?," Economics Letters, 60 (1), 49-53.

Park, C. Whan, Sandra Milberg, and Robert Lawson (1991), "Evaluation of Brand Extensions: The Role of Product Feature Similarity and Brand Concept Consistency," Journal of Consumer Research, 18 (2), 185.

Patalano, Andrea L., Seth Chin-Parker, and Brian H. Ross (2006), "The Importance of Being Coherent: Category Coherence, Cross-Classification, and Reasoning," Journal of Memory and Language, 54 (3), 407-24.

Patalano, Andrea L., Steven M. Wengrovitz, and Kirsten M. Sharpes (2009), "The Influence of Category Coherence on Inference about Cross-Classified Entities," Memory and Cognition, 37 (1), 21.

Pauwels, Koen, Jorge Silva-Risso, Shubha Srinivasan, and Dominique M. Hanssens (2004), "New Products, Sales Promotions, and Firm Value: The Case of the Automobile Industry," Journal of Marketing, 68 (4), 142-56.

Rangaswamy, Arvind, Raymond Burke, and Terence A. Oliver (1993), "Brand Equity and Extendibility of Brand Names," International Journal of Research in Marketing, 10 (March), 61-75.

Rao, Vithala R. (2008), Developments in Conjoint Analysis: Springer Science+Business Media, LLC.

Rao, Vithala R., Manoj K. Agarwal, and Denise Dahlhoff (2004), "How is Manifest Branding Strategy Related to the Intangible Value of a Corporation?," Journal of Marketing, 68 (4), 126-41.

Rehder, Bob and Reid Hastie (2004), "Category coherence and category-based property induction," Cognition, 91 (2), 113-53.

Salop, Steven C. (1979), "Monopolistic Competition with Outside Goods," The Bell Journal of Economics, 141-56.

Shimizu, Daisuke (2002), "Product Differentiation in Spatial Cournot Markets," Economics Letters, 76 (3), 317-22.

Simon, Carol J. and Mary W. Sullivan (1993), "The Measurement and Determinants of Brand Equity: A Financial Approach," Marketing Science, 12 (1), 28-52.

Simonson, Itamar (1999), “The Effect of Product Assortment on Buyer Preferences,” Journal of Retailing, 75(3), 347-370.

Slovic, Paul and Douglas MacPhillamy (1974), “Dimensional Commensurability and Cue Utilization in Comparative Judgment “, Organizational Behavior and Human Performance, 11, 172-194.

Smith, Daniel C. and C. Whan Park (1992), "The Effects of Brand Extensions on Market Share and Advertising Efficiency," Journal of Marketing Research, 29 (3), 296-313.

Sudhir, K. (2001), "Competitive Pricing Behavior in the Auto Market: A Structural Analysis," Marketing Science, 20 (1), 42-60.

Sujan, Mita and Christine Dekleva (1987), "Product Categorization and Inference Making: Some Implications for Comparative Advertising," Journal of Consumer Research, 14 (3), 372-78.

Tversky, Amos (1977), “Features of Similarity”, Psychological Review, 84(4), 327-352

Vakratsas, Demetrios, Fred M. Feinberg, Frank M. Bass, and Gurumurthy Kalyanaram (2004), "The Shape of Advertising Response Functions Revisited: A Model of Dynamic Probabilistic Thresholds," Marketing Science, 23 (1), 109-19.

Volckner, Franziska and Henrik Sattler (2006), "Drivers of Brand Extension Success," Journal of Marketing, 70 (2), 18-34.

Wernerfelt, Birger (1988), "Umbrella Branding as a Signal of New Product Quality: An Example of Signalling by Posting a Bond," The Rand Journal of Economics, 19 (3), 458-66.

Wilton, Peter C. and John G. Meyers (1986), “Task, Expectancy, and Information Assessment Effects in Information Utilization Processes,” Journal of Consumer Research, 12(March), 469-86.

Wyer, Robert S. (1970), “Information Redundancy, Inconsistency, and Novelty and their Role in Impression Formation”, Journal of Experimental Social Psychology, 6(January), 111-27.

Wyer, Robert S. and Donal E. Carlston (1979), *Social Cognition, Inference, and Attribution*, Hillsdale, NJ: Lawrence Erlbaum Associates.